Amateur Radio

COMMUNICATIONS & TECHNOLOGY

MARCH 2005

CQ

1945 Our 60th Anniversary 2005

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On the Cover: Ralph Bartlett, W4ZO, of Indian Trail, North Carolina, with his collection of vintage ham equipment. Details on page 40.

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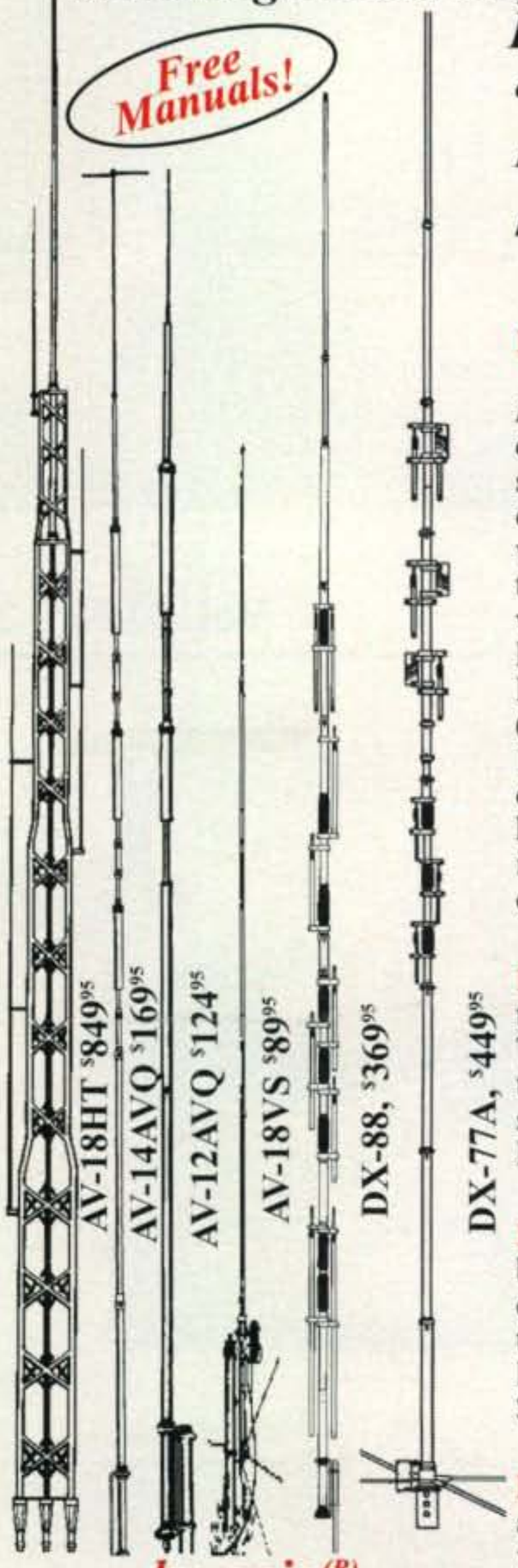

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Model #	Price	Bands	Max Power	Height	Weight	Wind Surv.	Rec. Mast
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AV-14AVQ	**$169.95**	**10,15,20,40**	**1500 W PEP**	**18 feet**	**9 pounds**	**80 MPH**	**1.5-1.625"**
AV-12AVQ	$134.95	10/15/20 M	1500 W PEP	13 feet	9 pounds	80 MPH	1.5-1.625"
AV-18VS	**$89.95**	**10 - 80 M**	**1500 W PEP**	**18 feet**	**4 pounds**	**80 MPH**	**1.5-1.625"**
DX-88	$369.95	10 - 40 M	1500 W PEP	25 feet	18 pounds	75 mph no guy	1.5-1.625"
DX-77A	**$449.95**	**10 - 80 M**	**1500 W PEP**	**29 feet**	**25 pounds**	**60 mph no guy**	**1.5-1.625"**

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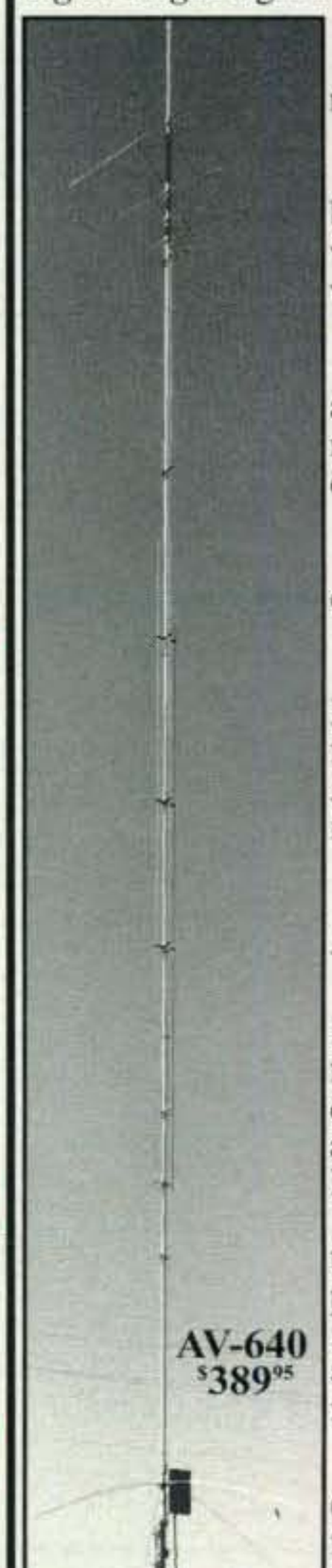

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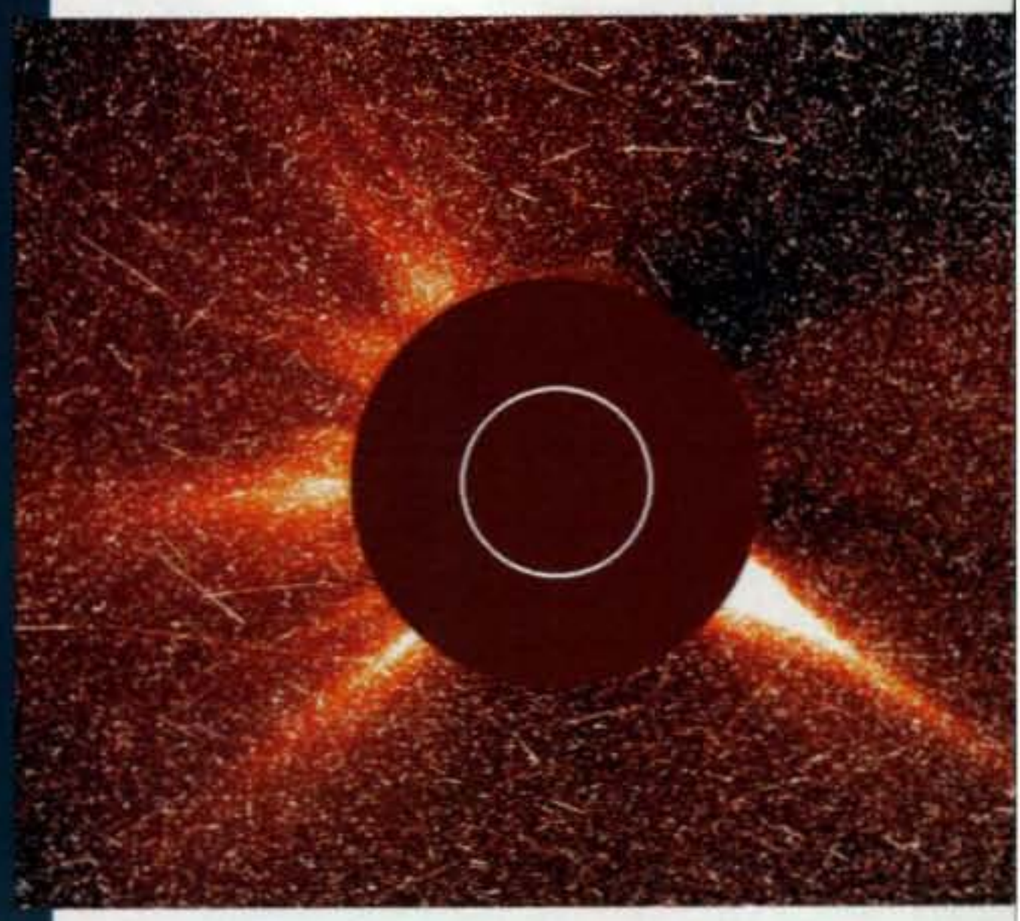

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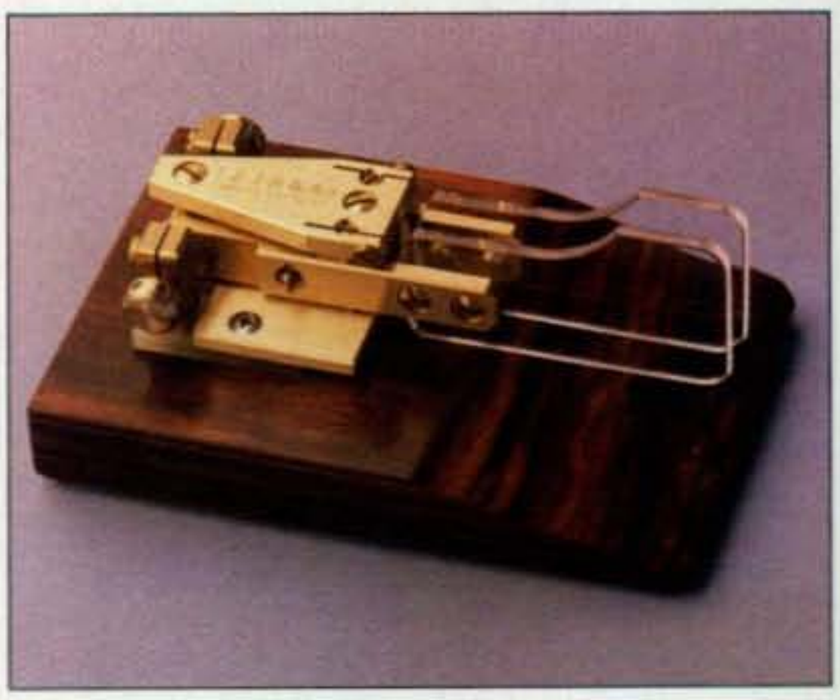

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ham radio news

Powell Stepping Down as FCC Chairman

FCC Chairman Michael Powell announced his resignation from the Commission the day after President Bush was inaugurated for his second term. However, Powell's resignation does not take effect until sometime in March. Powell was best-known among hams for his strong promotion of Broadband over Power Lines, or BPL, despite the fact that FCC commissioners are not supposed to show favoritism for one technology over another. Powell oversaw the implementation of new rules that permit BPL with some restrictions, but there is considerable doubt as to how effectively they will be able to be enforced.

At press time, speculation on Powell's replacement centered on Commissioner Kevin Martin, who is also a Republican but did not see eye-to-eye with Powell on some major issues; National Telecommunications and Information Administration chief Michael Gallagher, who is quite familiar with amateur radio; and, according to the *New York Times,* Texan Becky Klein, who was appointed in the 1990s by then Governor George W. Bush to that state's utility regulatory agency.

Europe Adopts New Standards for Electromagnetic Compatibility

The European Parliament has approved new rules on that prohibit devices that generate RF energy from causing interference that makes it impossible for radio equipment to "operate as intended." The new rules, adopted last December 15 and published on December 31, specifically include amateur radio among services to be protected from interference.

"Member states are responsible for ensuring that radiocommunication, including radio broadcast reception and the amateur radio service operating in accordance with the International Telecommunication Union (ITU) radio regulations …are protected against electromagnetic disturbance," according to the new directive.

"Electromagnetic disturbance" is defined as "any electromagnetic phenomenon which may degrade the performance of equipment," and the new rules require that equipment be designed and manufactured to ensure that "the electromagnetic disturbance generated does not exceed the level above which radio and telecommunications equipment … cannot operate as intended." The rules also require that immunity to "expected" levels of disturbance be built into commercially manufactured equipment. Compliance with these rules is mandatory in order for equipment to receive "CE" certification for sale within the European Union. It is not yet clear how these new rules might affect Broadband over Power Lines (BPL) equipment, but most manufacturers with international distribution seek CE certification for their products.

Canadian Hams Support Ending Morse Requirement

Industry Canada (IC), that country's communications regulatory agency, says VE hams are in "overwhelming agreement" that passing a Morse code exam should no longer be "the sole means of gaining access" to HF amateur bands. According to a report on the ARRL website, the Radio Amateurs of Canada (RAC) says the comments reflect views filed with IC in response to a request for input from the amateur community. Industry Canada has not yet acted on an RAC restructuring proposal … just as the FCC in the United States has yet to act on a variety of restructuring proposals that followed the International Telecommunications Union's 2003 decision to make Morse testing for HF access optional by country.

3YØX DXpedition Delayed

Problems in preparing the ship chartered to take the 3YØX DXpedition team to Peter I Island off Antarctica in January have caused the trip to be delayed by at least a month. Expedition co-leaders Bob Allphin, K4UEE, and Ralph Fedor, KØIR, said in a news release that the charter company has promised that the ship would be ready to go by February 10, and that the team would be ready as well, even though they didn't have too much faith in the timetable. If the group does leave on February 10, the trip to Peter I should take about a week, with operations planned between completion of setup and the first week in March. Updated information is available on the DXpedition's website at <http://www.peterone.com>.

FCC Goes After Interference from Homeowners

The FCC has contacted four homeowners in different states whose home electrical equipment is apparently causing interference to ham radio. Devices cited include an aquarium light, a security alarm system, something called a "resonant frequency therapy" device, and an unidentified device—possibly house wiring itself. All of the letters' recipients are urged to work with the affected hams to resolve the problems or to contact the ARRL's RFI desk for help, and to notify the Commission within a month of steps being taken to resolve the problems.

UO-22 May Be Dead

UoSat OSCAR-22, for years a workhorse digital amateur satellite, may have reached the end of its "useful life," according to the AMSAT News Service. The satellite stopped working in late 2004—possibly due to battery problems or excessive heating—and controllers have been unable to get it working again. UO-22 was launched in 1991 and has been a major part of the worldwide "SatGate" packet radio message-forwarding system.

Ham's Tower Case Goes to Supreme Court

A legal dispute between the city of Rancho Palos Verdes, California, and resident Mark Abrams, WA6DPB, was argued in January before the U.S. Supreme Court. The dispute involves commercial antennas placed on Abrams' already-approved amateur tower, and Abrams won several court decisions blocking the city's efforts to keep him from using the tower for commercial antennas as well. The question before the high court is whether Abrams is entitled to collect damages and attorney's fees from the city, a matter that has broad implications for any municipality attempting to limit the growth of towers for cell phones and other uses within its borders. According to a report in the *Los Angeles Times,* the justices' questions suggested they were most likely to rule in favor of the cities. A decision is likely in late spring.

U5MIR to Return to Space Station

Cosmonaut Sergei Krikalev, U5MIR, is slated to return this spring to the International Space Station, this time as mission commander. The *ARRL Letter* reports that his crewmate will be Astronaut John Phillips, who does not currently hold an amateur license. Krikalev has been very active on ham radio from space, starting during a stint on the old Russian Mir space station. Back on Earth, he has also been very active in the Amateur Radio on the International Space Station (ARISS) program team.

Additional and updated news is available on the Ham Radio News page of the CQ website at <http://www.cq-amateur-radio.com>. For breaking news stories, plus info on additional items of interest, sign up for CQ's free online newsletter service. Just click on "CQ Newsletter" on the home page of our website.

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HAM IV and HAM V Rotator Specifications	
WindLoad capacity (inside tower)	15 square feet
Wind Load (w/mast adapter)	**7.5 square feet**
Turning Power (in lbs.)	800
Brake Power (in lbs.)	**5000**
Brake Construction	Electric Wedge
Bearing Assembly	**dual race/96 ball bearings**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight (lbs.)	26
Effective Moment (in tower)	**2800 ft/lbs.**

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T-2X
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$1029.95
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For large medium antenna arrays up to 20 sq. ft. wind load. Available with *DCU-1 Pathfinder* digital control (T2XD) or standard analog control box (T2X) with *new* 5-second brake delay and *new* Test/ Calibrate function. Low temperature grease, alloy ring gear, indicator potentiometer, ferrite beads on potentiometer wires, *new* weatherproof AMP connectors plus 8-pin plug at control box, triple bearing race with 138 ball bearings for large load bearing strength, electric locking steel wedge brake, North or South center of rotation scale on meter, low voltage control, 2 1/16 inch max. mast.

TAILTWISTER Rotator Specifications	
Wind load capacity (inside tower)	20 square feet
Wind Load (w/ mast adapter)	**10 square feet**
Turning Power (in lbs.)	1000
Brake Power (in lbs.)	**9000**
Brake Construction	Electric Wedge
Bearing Assembly	**Triple race/138 ball brngs**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight (lbs.)	31
Effective Moment (in tower)	**3400 ft/lbs.**

CD-45II

CD-45II
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For antenna arrays up to 8.5 sq. feet mounted inside tower or 5 sq. ft. with mast adapter. Low temperature grease good to -30 F degrees. *New* Test/Calibrate function. Bell rotator design gives total weather protection, dual 58 ball bearing race gives proven support. Die-cast ring gear, stamped steel gear drive, heavy duty, trouble free gear train, North center scale, lighted directional indicator, 8-pin plug/socket on control unit, snap-action control switches, low voltage control, safe operation, takes maximum mast size to 2 1/16 inches. MSLD light duty lower mast support included.

CD-45II Rotator Specifications	
Wind load capacity (inside tower)	8.5 square feet
Wind Load (w/ mast adapter)	**5.0 square feet**
Turning Power (in lbs.)	600
Brake Power (in lbs.)	**800**
Brake Construction	Disc Brake
Bearing Assembly	**Dual race/48 ball brings**
Mounting Hardware	Clamp plate/steel U-bolts
Control Cable Conductors	**8**
Shipping Weight (lbs.)	22
Effective Moment (in tower)	**1200 ft/lbs.**

HAM-V

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$949.95
with DCU-1

For medium antenna arrays up to 15 square feet wind load area. Similar to the HAM IV, but includes *DCU-1 Pathfinder* digital control unit with gas plasma display. Provides automatic operation of brake and rotor, compatible with many logging/contest programs, 6 presets for beam headings, 1 degree accuracy, auto 8-second brake delay, 360 degree choice for center location, *more!*

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MSHD, $99.95. Heavy duty mast support for T2X, HAM-IV and HAM-V.
MSLD, $39.95. Light duty mast support for CD-45II and AR-40.
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AR-40

AR-40
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For compact antenna arrays and large FM/TV up to 3.0 square feet wind load area. Dual 12 ball bearing race. Automatic position sensor never needs resetting. Fully automatic control -- just dial and touch for any desired location. Solid state, low voltage control, safe and silent operation. 2 1/16 inch maximum mast size. MSLD light duty lower mast support included.

AR-40 Rotator Specifications	
Wind load capacity (inside tower)	3.0 square feet
Wind Load (w/ mast adapter)	**1.5 square feet**
Turning Power (in lbs.)	350
Brake Power (in lbs.)	**450**
Brake Construction	Disc Brake
Bearing Assembly	**Dual race/12 ball bearings**
Mounting Hardware	Clamp plate/steel bolts
Control Cable Conductors	**5**
Shipping Weight (lbs.)	14
Effective Moment (in tower)	**300 ft/lbs.**

HDR-300A

HDR-300A
$1379.95

For ***king-sized*** antenna arrays up to 25 sq.ft. wind load area. Control cable connector, *new* hardened stainless steel output shaft, *new* North or South centered calibration, *new* ferrite beads on potentiometer wires reduce RF susceptibility, *new* longer output shaft keyway adds reliability. Heavy-duty self-centering steel clamp and hardware. Display accurate to 1°. Machined steel output.

HDR-300A Rotator Specifications	
Wind load capacity (inside tower)	25 square feet
Wind Load (w/ mast adapter)	**not applicable**
Turning Power (in lbs.)	5000
Brake Power (in lbs.)	**7500**
Brake Construction	solenoid operated locking
Bearing Assembly	**bronze sleeve w/rollers**
Mounting Hardware	stainless steel bolts
Control Cable Conductors	**7**
Shipping Weight (lbs.)	61
Effective Moment (in tower)	**5000 ft/lbs.**

Digital Automatic Controller

DCU-1
$649.95

Automatically controls T2X, HAM-IV, V rotators. 6 presets for favorite headings, 1 degree accuracy, 8-sec. brake delay, choice for center of rotation, crisp *plasma* display. Computer controlled with many logging/contest programs.

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a CQ editorial

BY RICH MOSESON,* W2VU

Learning How Little We Know

"It's kind of complicated," I told the group of fifth graders, explaining how the IRLP[1] connection we were about to make with Palmer Station, Antarctica, involved my radio sending a signal to another radio, which was connected to the Internet, which at some point uplinked the signal to a satellite, which was then downlinked at Palmer Station and sent out by radio to the operator at the bottom of the world. "And we could try it without the Internet and the satellite," I continued, "by bouncing our signals off that radio mirror in the sky we talked about last week – the ionosphere. But you can never be sure where the ionosphere is going to let you talk on a given day. So while our setup with the Internet and the satellite is more complicated, it's also more reliable."

Wrong. We were able to open the link to Palmer Station but no one seemed to be there to answer our call, despite having set up a schedule and tested the link a couple of days earlier. When I got home, I found an e-mail waiting from Bill, KD7CWA, my contact in Antarctica. "Sorry to miss the sked today," he wrote. "Our link has been marginal all day due to the solar flares."

The solar flares. Of course. Just the day before, I'd been reading NW7US's "Propagation" column for this issue (starting on page 94), in which he describes in great detail the huge solar flares and coronal mass ejections (CMEs) of mid-January. The energized particles from the sun were so intense that sensors aboard satellites designed to measure just such events became overloaded (there were still no readings five days later). There were radio blackouts on HF in some parts of the world, and a strong likelihood of aurora contacts on VHF (at press time, I hadn't begun seeing reports yet. Check out N6CL's "VHF-Plus" column next month to see what happened).

While active auroras are great DX-producers for VHF stations outside the auroral zones, stations within those zones essentially have a radio blanket over their heads. Bill explained that the flares had effectively shut down their satellite uplink capability that morning. In addition, the same particles that oversaturated the instruments on the solar observing satellites overloaded a commercial satellite relied upon by other Antarctic stations and many south Pacific islands. According to Bill, much of that traffic had been moved to "their" satellite, which became "packed to the gills" and resulted in co-channel interference because some of the carriers had not yet been properly aligned. We rescheduled the sked for the following week (after press time) and hoped for better conditions.

Meanwhile, the ionosphere remained firmly in control of long-distance radio communications, even with the supposedly greater reliability of the internet/satellite link we were trying to use. And next week, my group of fifth graders will get an impromptu introduction to solar physics and the Earth's magnetic field while I try to explain why my previous explanation turned out to be, well, wrong. Now I consider myself fairly well-educated in this stuff and I got to wondering how I could have been so far off-base. One of the things that NW7US explains in his column this month is that it's really not that unusual to have big solar flares and CMEs like this in the waning days of a sunspot cycle. And he's got all sorts of cool graphs from the internet and readings from satellite sensors to illustrate his explanations.

Out of curiosity, I went back eleven years, to W3ASK's Propagation columns in *CQ* in late 1993 and early 1994, when cycle 22 was at about the same point that cycle 23 is today. Apparently, there wasn't much solar flare activity of any consequence during that time period, since George didn't report on any. What really struck me, though, were the technological advances we've made in just over a decade in observing, measuring and reporting on solar activity as it affects radio communications here on Earth. In the 1994 columns, there were no references to solar-observing satellites, to measurements of solar wind speed or "proton bursts." There was also no World Wide Web from which we could download graphs or get real-time reports of satellite observations, just a couple of references to computer bulletin boards you could dial into with your (presumably 300 baud) telephone modem.

Mike Scharfstein, WA2JSB, acts as control operator while 5th graders from Bloomfield, New Jersey's public schools talk via IRLP (Internet Repeater Linking Project) with hams in Scotland, Utah and other places. (W2VU photo)

We've learned a tremendous amount in the past decade about the workings of the sun, its interactions with Earth's magnetic field and the effects of those interactions on our ability to communicate long distances by radio. But when it comes down to it, there's still a whole lot that we don't know. We were still taken by surprise by the sunspot group that appeared without warning and quickly grew to seven times the size of Earth, and by the number and magnitude of the flares and CMEs that originated from that "active zone" on the sun. Our sophisticated monitoring equipment was overwhelmed and all the fancy sensors read zero ... and the satellites on which we've come to depend for routine communication with remote places turned out to be undependable.

Likewise, advances in knowledge about plate tectonics and other causes of earthquakes could do nothing to prevent the massive tsunami that followed a huge earthquake in the Indian Ocean in late December, nor the massive numbers of casualties that resulted (see WA3PZO's report on ham radio's role after the tsunami, beginning on page 11).

It sometimes seems that the more we learn, the more we learn how little we know.

Back to School

In closing, a few notes on radio and kids. We've gotten some very positive feedback on January's "Magic in the Sky" column, in which guest columnist Sean Barnes, N3JQ, described how he's worked ham radio into his high school science classes. And I am in the middle of my fourth year of doing an "enrichment cluster" on hobby radio for fifth graders in my home town of Bloomfield, New Jersey (see photo). While we didn't get through to Antarctica on the first try, we did make several other IRLP contacts - from Utah to Scotland - the kids did some broadcast band DXing on their own at home, and they've all gotten a good first taste of what hobby radio is all about. And oh yes, as in past years, they just *love* talking on the radio ... and Morse code. 73, Rich W2VU

Note

1. IRLP is the Internet Repeater Linking Project, one of several networks linking hams and ham repeaters via the internet. For more information, see <http://www.irlp.org>.

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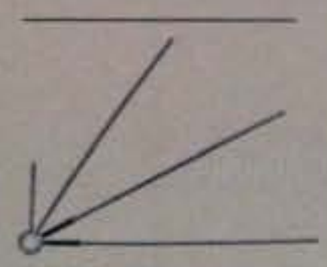

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announcements

New DX Forum – A new DX forum is being hosted at the GB7MBC DXCluster. It is for all DXers and DXCluster users. It can be found at: <http://www.gb7mbc.net/forum/>.

Virginia QSO Party – This event will take place March 19–21. For details, go to: <http://www.qsl.net/sterling/VA_QSO_Party/QSOParty.htm>.

ARLHS Spring Lites QSO Party – The Amateur Radio Lighthouse Society will host this annual event March 26 through April 3. Rules, etc., can be found at: <http://arlhs.com/SL-2005-guidelines.html>. Questions may be directed to e-mail: <lighthouse@arlhs.net>.

W4BKM Special Event Station – The Macon (GA) ARC will operate W4BKM from 1500–2200Z Saturday, March 19, at the 23rd annual Cherry Blossom Festival on SSB 14.240 and 21.335 MHz, CW 7.055, 14.055, and 18.075 MHz. For certificate send QSL and 9×12 SASE to Macon ARC, P.O. Box 4862, Macon, GA 31208.

The following hamfests, etc., are scheduled for March:

March 5, **VE2UMS Annual Fleamarket,** Centre Roussin, Montreal, QC, Canada. Reservations call 514-521-7765, or e-mail: <hamfest@ve2ums.ca>; <http://www.ve2ums.ca>. (Talk-in 146.700 [–])

March 5, **Charlotte County Tailgate-Fest,** Charlotte County Fairgrounds, Port Charlotte, Florida. Contact Reg Knarzer, K9ZKS, 941-627-9828. (Talk-in 147.255)

March 11–12, **Acadiana ARA Hamfest & ARRL Louisiana State Convention,** Rayne Civic Center, Rayne, Louisiana. For info go to: <http://www.w5ddl.org/hamfest>. (Talk-in 146.82; exams 2 PM)

March 12, **Cave City Hamfest,** Cave City Convention Center, cave City, Kentucky. Contact Larry Brumett, KN4IV, 270-651-2363; e-mail: <lbrumett@glasgow-ky.com>; <www.geocities.com/ky4x2000>. (Exams 9 AM)

March 12, **Cherryville Repeater Assn. II Hamfest,** North Huntgerdon Regional High School, Rt. 31 south of Clinton, New Jersey. Telephone 908-788-4080; e-mail: <hamfest@earthlink.net>; <www.qsl.net/w2cra>. (Talk-in 147.375, PL 151.4)

March 13, **Vienna Wireless Society Winterfest,** Northern Virginia Community College, Annandale, Virginia. Table reservations contact Len Hook, KG6ZR, 703-366-3979 or e-mail: <tablesales@viennawireless.org>; web: <www.viennawireless.org>. (Talk-in 146.31; exams March 12, 9 AM to 12 noon)

March 19, **Kennehoochie ARC Hamfest**, Southern PolyTech State University, Marietta, Georgia. Contact E. S. Kanter, W4PGI, 770-815-1570; e-mail: <w4pgi@arrl.net>. (Talk-in 146.880 [–], PL 100; exams)

March 19, **Charleston, WV Area Hamfest & Computer Show,** Coonskin Armory, Charleston, West Virginia. Contact Jim Damron, N8TMW, e-mail: <n8tmw@arrl.net>. (Talk-in 145.35; exams 12:30 PM)

March 19–20, **Midland ARC St. Patrick's Day Hamfest,** Midland County Exhibit Building, Midland, Texas. Contact Joe, KK5ZG, e-mail: <kk5zg@caprok.net>; <www.w5qgg.org>. (Talk-in 147.300)

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Tsunami!

Hams Provide Critical Links in Massive Disaster

BY BOB JOSUWEIT,* WA3PZO

At the equivalent of the snap of a finger, a massive 9.0 earthquake erupted under the Indian Ocean near Sumatra and triggered a tsunami that raced at speeds of up to 500 mph toward the coasts of Indonesia, Sri Lanka, India, and other nations, killing over 150,000 people and displacing millions more. It also triggered an international amateur radio response that was there to "Help All Mankind." This month we take a look at the international amateur radio response and the important role amateur radio operators played at a moment's notice.

*c/o CQ magazine
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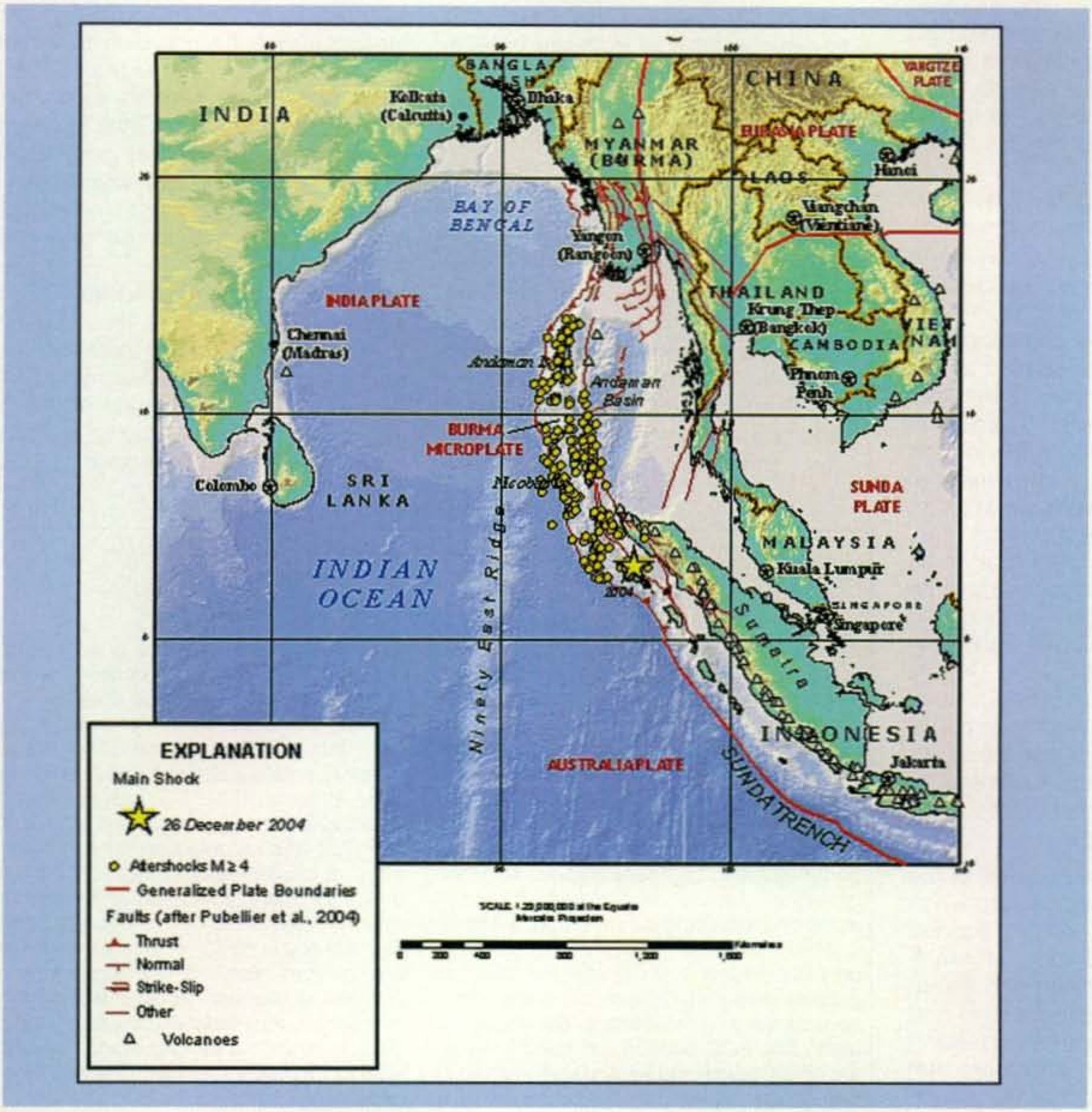
DXpedition Turns into EmComm Central

The National Institute of Amateur Radio in Hyderabad, India sponsored a DXpedition to Port Blair, Andaman and Nicobar Islands for the month of December. The calls were VU4RBI and VU4NRO. Little did the operators know that this rare DXpedition to these picturesque islands in the Bay of Bengal between India and Thailand would become



Over 150,000 people were killed by the earthquake-triggered tsunami. The earthquake measured 9.0 on the Richter scale. This is the fourth largest earthquake in the world since 1900 and the largest since the 1964 Prince William Sound, Alaska earthquake. (Map courtesy of the U. S. Geological Survey)

Adam Steed, KE7EBX, hopes to be able to use Echolink to maintain contact back to the U.S. while he is in Sri Lanka. (Photo courtesy of Doug McKay, KD7LRJ)

the center for emergency communications in one of the hardest hit areas of India. This was the first time amateur radio operations had taken place on Andaman and Nicobar Islands since 1987. Previous national security concerns of local officials were laid to rest as the hams proved to be good Samaritans.

Indian hams provided a national response with several teams traveling to the affected areas. VU2DVO and VU2JOS went to Port Blair. They reported that some landlines were working in Andaman, but there was no electricity or water at VU4NRO's location at the Hotel Sinclair in Port Blair. They also reported that one of the hardest hit areas, Car Nicobar, was totally cut off and thousands of people were missing. Ham radio operators were expected to travel to the area as soon as they received permission from the local authorities. Amateur radio communications were considered so important that stations were being set up at many government offices, including the Deputy Commissioner's office in Port Blair. According to government reports as of this writing, over half of the island's population is now living in refugee camps.

The VU4 DXpedition

Bharathi Prasad, VU2RBI, was on the air talking to an Indonesian ham when the earthquake struck. "All of a sudden I felt tremors at around 6:29 AM. I realized it to be an earthquake and shouted 'tremors' into the microphone and rushed out of the room raising alarm alerting others." After checking that everyone was safe and that the antennas were still on the roof, Prasad got back on the air and contacted HSØZAA in Thailand and VU2UU and VU2MYL on the Indian mainland. Both confirmed the tremors at their locations. "I could guess the magnitude of the damage due to the earthquake and decided to suspend the DXpedition operations and started emergency communication with the mainland (VU) and other people from then onwards by turning the antenna beam to mainland."

At the hotel, Charlie Harpole, K4VUD, who was helping with the DXpedition, described what he felt during the earthquake: "Morning after Xmas, I was resting . . . and thinking about what to do that coming day when my bed started to quiver like a large train was coming by. Then the room started to rock about when I stood up. Walking and standing were difficult. Bottles were falling off the shelves, and my fifth floor room floor felt like rubber. I got braced within the bathroom doorway until things settled down. Then I found my pants and shirt and ran, shoes in hand, down the stairs and joined everyone else from the hotel in the open out front. Bharathi was already safely outside there. She was on the air at the time, but quickly figured out what was happening and got out."

Harpole continued, "By that afternoon, the team had set up one rig outside with a mobile whip and tuner . . . powered by the hotel generator . . . and Bharathi was taking health and welfare messages from the people standing around there. Many wanted to tell relatives on the Indian mainland that they were okay, and Bharathi established contact with many India ham stations in various cities as needed. Traffic was being passed. She told my wife in Thailand that I was okay via contact with an HS station who passed the message by telephone in Thailand . . . very nice to be a ham!

"The team got cots from the hotel and, along with most others, slept out in the open that night. I slept fitfully near the lobby door on a couch inside, reasoning rightly this time that the worst was over. Even when the hotel generator had to be shut down for an hour from time to time, Bharathi used an automobile battery and lower power."

Prasad said that within a few hours they heard about the extent of damage in Port Blair. While the news of death and devastation caused by the tsunami/earthquake in other parts of India was quickly transmitted around the world, the situation in Andaman and Nicobar Islands was not known. Prasad said she "went on broadcasting information about the situation to anyone who could hear my signals. Simultaneously, I have sent my team members to the office of the Chief Secretary, Government of Andaman and Nicobar Islands expressing our willingness to extend our support for establishing emergency communication for the help of administration."

The Deputy Commissioner (DC) requested their services the next day. VU2RBI and VU3RSB established a radio station in the control room of the DC's office. At the request of the DC, two of the team members (VU2MYH and VU2DVO) proceeded to Car

Disaster-Related Amateur Communications Between South Asia and the U.S.

By Fred Maia, W5YI

Amateur radio emergency communications—especially the passing of health and welfare messages—were under way at press time in the many South Asian countries affected by the massive December 26th earthquake and subsequent tsunami (tidal wave).

None of these countries, however, has a third-party traffic agreement with the U.S., and a question has been raised about the legality of disaster-related traffic between those countries and U.S. amateur stations.

The American Radio Relay League recently quoted an FCC staff member regarding third-party health and welfare traffic with amateur stations in the impacted area. The FCC pointed out that the international Radio Regulations were revised at the 2003 World Radiocommunication Conference (WRC-03) to provide that amateur stations may be used for transmitting international communications on behalf of third parties in case of emergencies or disaster relief, even without a specific agreement between the countries involved, unless one of the countries objects.

The FCC staffer said: "An administration may determine the applicability of this provision to amateur stations under its jurisdiction. Although the FCC has not formally adopted the changes approved at WRC-03, the FCC has no objection to U.S. stations passing disaster-related traffic to and from stations in the affected areas if the administrations responsible for the Amateur Service in those countries do not object to their amateur stations receiving messages from our amateur stations on behalf of third parties." In addition, the Radio Amateurs of Canada (RAC) reports that Canada's regulatory agency, Industry Canada, issued a similar statement. Therefore, as long as there is no objection from any of the affected countries, it is legal for U.S. and Canadian hams to send and receive disaster-related third-party traffic to/from those countries.

Visit Our Web Site

Pilot HS1HBJ used his airplane to survey damage in Thailand. (Photo courtesy of Phat, HS1WFK)

Nicobar Island the next morning on a military aircraft and established communication between Port Blair and Nicobar. Hundreds of messages were passed each day between the mainland and the affected areas. One report said the number of messages reached 30,000. The only link for thousands of Indians and other country people who were worried about their friends and families on the islands was ham radio.

"Our station in the control room became the center of messages between Port Blair and Nicobar Island," said Prasad. "Survivors in Car Nicobar were communicating with their relatives in Port Blair through our stations. Other hams of the country located on the mainland have helped us in relaying the messages whenever there was skip between our stations in the islands. When telephone lines were restored on Tuesday, the 28th of December, the information received on the radio about the survivors from Car Nicobar, that they were alive, was conveyed to their anxious relatives on the mainland. We also helped about 15 foreign tourists, including several from the U.S., to send news to their families."

VU2JOS, along with other government officials, was sent to Hudbay Island for relief activity. "The common man was totally happy in utilizing our service, and the magnitude of their satisfaction on receiving the information about the welfare of their kith and kin was beyond one's imagination," said Prasad. Tremors continued for the next six days.

As the strong aftershocks continued throughout the night, the station remained on the air passing traffic to the Indian mainland. While some telephone service was restored the next day, the DXpedition operators reported the local authorities were "quite hungry for information on casualties in the region, since they have only a trickle of news from the outside. It seems that amateur radio is showing its value during a severe crisis."

The efforts of the ham radio operators across India were very much appreciated by the "Chief Secretary" of the Andamans.

The tsunami left a path of death and destruction up to 4 miles from the coast. (Photo courtesy of KD7LRJ)

Technology Combined

During recent disasters we have seen the growing use of the internet combined with amateur radio. This disaster was no different. Sandeep, VU2MUE, said the "different technologies complemented each other."

A very long relief message for New Delhi was transmitted by Mohan, VU4/VU2MYH, in Car Nicobar on 30 December. VU2MUE could not copy the message because of poor propagation. The message was copied by Horey, VU2HFR, in Calcutta for relay to New Delhi. Instead of relaying the message on the air, VU2HFR in Calcutta typed it on his laptop computer and e-mailed it to Sandeep, VU2MUE, for further relay to the Director of Emergency Medical Relief Control Room in New Delhi. Confirmation that the message had been delivered was relayed back to the disaster area via amateur radio. Dr. Ravindran, Director of Emergency Medical Relief, thanked the ham radio volunteers for their support in handling government relief messages.

Many of the relief messages handled dealt with the daily number of deaths, missing, and injuries that each of us heard on the news. The Andamans accounted for about a third of India's reported death toll of 11,330. Thousands more were reported missing or have been separated from families in the archipelago's 572 islands because of massive damage to harbors, bridges, and local ferry services. When Bharathi, VU2RBI, returned from the Andaman Islands, Gopal, VU2GMN, said she was very, very tired (not unexpectedly) but happy that she and her team were able to assist in a time of need. According to newspaper accounts, an Indonesian ham radio operator told her, "Bharathi, we are now on air. You take care. You are the Angel of the Seas. Without you out there, rescue will halt."

Military Tunes in Ham Disaster Nets

As relief aid headed for the area, reports surfaced of both Canadian and U.S. naval vessels tuning in on local amateur radio emergency nets in the Andaman Islands and Sri Lanka.

A Call for Help

Sarath, 4S7SW, a physician operating near a hospital in Mathara, Sri Lanka, which was severely damaged by the

tsunami, put out a call for food, clothing, and medicines for relief. According to C. K. "Ram" Raman, VU3DJQ, Sarath was monitoring frequencies on 15 and 20 meters. Indian hams had also established a net on 40 meters.

Victor Goonetilleke, 4S7VK, president of the Radio Society of Sri Lanka (RSSL), reports that "uncomplicated shortwave" radio saved lives. "Ham radio played an important part and will continue to do so," he said in an e-mail relayed to the ARRL. Goonetilleke said that even Sri Lanka's prime minister had no contact with the outside world until amateur radio operators stepped in. "Our control center was inside the prime minister's official house in his operational room," he recounted. "[This] will show how they valued our services."

Goonetilleke reported that even satellite phones failed, and only the amateur radio HF link remained open. One problem: Batteries were running out, and there were no generators to recharge them. A ham radio link was maintained between Hambantota and the prime minister's disaster management office at *Temple* Trees, and government offices in the stricken area. According to Goonetilleke, "We closed the link after the police got a communications link up in Hambantota. We went in because the district secretary's office only had a satellite phone and communications was difficult." The Hambantota station was operated by Asantha Illesinghe, 4S7AK, Dimuthu Wickremesinghe, 4S7DZ, and Kusal Epa, 4S7KE.

Desperation Sets In

Goonetilleke reported that none of his family members or friends were killed, although the death toll in Sri Lanka reached more than 70,000. He told *CQ* that he was "running around and feeling still inadequate in what we are doing as hams. . . . My ordinary life has changed that I didn't realize that I hadn't even monitored the various frequencies I should. I am here with a lot of papers, telephone numbers, and all that, taking calls, answering calls, running to the VHF and HF and trying to coordinate something of a disaster communications link. It is no easy task when a disaster as terrible as this was beyond our thinking plane. The magnitude of the issue is such that sometimes I wonder how we are going to address this. There are heart-breaking situations where a single child remains, a mother, father, and so many lost. All too familiar be it Sri Lanka, India, or anywhere else."

"As President of the Amateur Radio Society in Sri Lanka," said Goonetilleke, "it was wonderful even at a tragic time to link up south of Sri Lanka with the prime minister, who comes from the south and that is where his people are. So we went in and established this HF link."

Links to Disaster

"My friends 4S7KE, 4S7AK, and 4S7DZ went in a 4-wheel drive approaching the coastal town of Hambantota from the interior, as the main road along the cost was badly battered and full of debris and was impassable," Goonetilleke continued. "I knew my propagation thanks to George Jacobs (W3ASK, *CQ* Propagation Editor Emeritus), and I could be 100% sure that we could keep a link going on 3 and 7 MHz. So when all the cellular and all other means failed, shortwave stood bold and proud. It is so simple, and we didn't even have a TS-50 or such a small mobile HF set, but took an ICOM IC-7400, the best radio we have, and two 12-volt batteries and dipoles, some food and water, and filled the rest of the vehicle with food for the displaced. I stood by in Colombo at the prime minister's (residence) to run the link in and coordinate."

Goonetilleke added, "I wish I could scream aloud and tell people in some high places that when all else is dead, SW (shortwave) is alive. What do you do when your power goes out, telephones go dead, and you can't even charge the batteries of your GTS (Global Telephone System) or mobile phone? We had our Morse key handy if we had to operate with just 1 or 2 watts, but the batteries held.

"Well the forces connected their links 12 or more hours later, but most of the district is so badly battered it will take some time to restore utilities. We operated for 48 hours from the prime minis-

HS1TKD reported shoreline damage, along with casualties. He is also a scuba diver and was assigned to survey for damage of the shore and coral spot in Surin Island. (Photo courtesy of HS1WFK)

A portable Echolink station was sent to Sri Lanka for communications back to the United States. It will be left behind as a gift to the Radio Society of Sri Lanka. (Photo courtesy of KD7LRJ)

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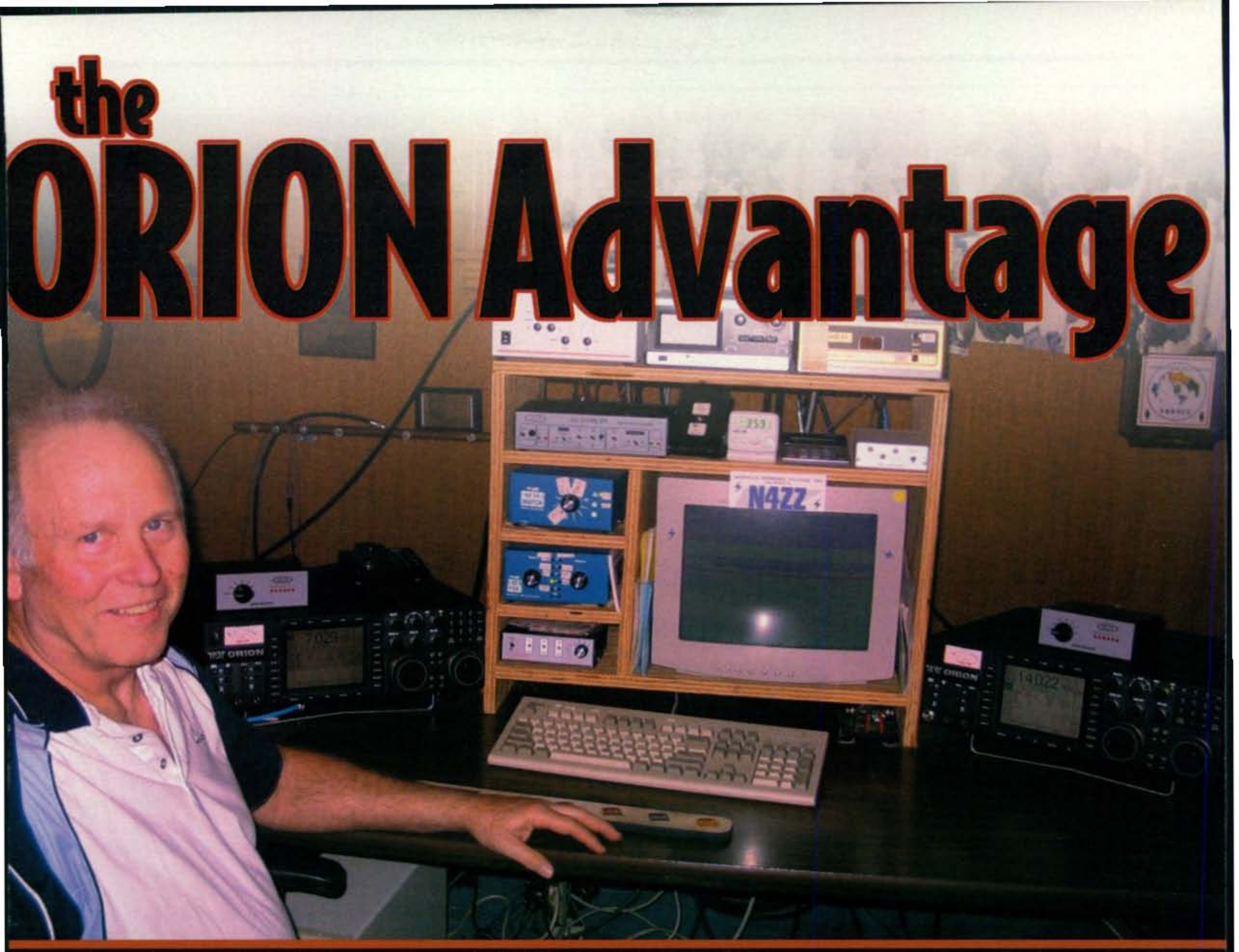

Don Binkley, N4ZZ, has been serious about amateur radio since obtaining his first license in 1957. Contests, DXing, ragchewing everyday with his friends on SSB and CW—Don does it all. Last year his friends kept telling him, "Don, you've got to try an Orion!", but Don wouldn't listen. He had a top-of-the-line HF transceiver from another company that he thought couldn't be beat. Why change? Then WB4QDA bought an Orion. W8KEB got one, too. And NA9F. So...Don decided he'd better try the Orion "just in case."

He could hear signals his other rig couldn't. Full break-in CW had never sounded so good. Everyone raved about the sound of the tailorable transmit audio. Operating contests were never so much fun! His friends had been right all along. That other top-of-the-line rig? Don sold it. He had to. He liked the Orion so much, he wanted to buy a second one for the operating table in his shack.

Find out what N4ZZ and thousands of other hams have already discovered—The Orion Advantage. Call Ten-Tec at (800) 833-7373, or visit our website at www.tentec.com, for more information on the Orion and Ten-Tec's complete amateur radio line. A 44-minute DVD or VHS instructional and informational video is available on the Orion for $10 postage-paid, refundable with later purchase of the transceiver.

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RF, the Internet, and Outer Space

Amateurs in the tsunami-stricken areas lauded the simplicity of amateur radio in getting through when nothing else could, but traditional voice and CW circuits were not the only paths used for communication to and from the affected areas.

Winlink

While the world's attention was focused on the devastated coastlines of Asia, there were other concerns to mariners at sea. Within hours of the earthquake, members of the Winlink administration team began checking records to see what ships in the Bay of Bengal had used the Winlink system in recent days. There was an immediate attempt to contact each of the ships and cruisers to make sure they were okay. As the days progressed, all ships reported they were safe.

Carl van Heerden, KF4PHC, and Beatrix Bachmann, KF4QBC, e-mailed Winlink developer Steve Waterman, K4CJX, thanking him for a great system and a superb service. "In times like this Winlink has been a blessing and a 'God send,' not just for us, but for our families, who have no other way of contacting us while we are traveling," said Heerden. "As you have gathered, we were under way, headed for the Island of Phi Phi, so due to the fact that we were in deep water, the tsunami had no adverse effect on the boat. On arrival at Phi Phi (4 hours after it hit) we found total devastation on and around the island. Due to lack of information on further waves, *all* vessels were advised to stand 'off shore,' so we carried on to Phuket. Monday morning on the Maritime Mobile net we proceeded to relay information regarding cruising boats. The majority of the tragedies were to the local people and hotel guests, and to date we do not know of any cruisers that were lost in the Thailand area."

Waterman said Winlink 2000 PMBO mailboxes in Perth, New South Wales, Qatar, the Netherlands, Austria, and South Africa are all moving traffic to and from the tsunami stricken areas on whatever basis it is sent. All traffic is sent at the same speed in terms of message flow. According to Waterman, "The only difference in any emergency is that the content changes. I suppose there may be more outbound third-party information, or more recipients per message, but really no user increases that are noticeable. Unlike other types of systems set up for EmComm, this system is used with or without EmComm daily by 6384 Winlink users to approximately 81,000 e-mail recipients. It takes a *huge* difference to be noticeable."

Echolink

Thai hams helped relay information between the affected areas along the west coast in the south to government agencies, mostly on VHF and 40 meters, as well as disseminated news and information over VHF frequencies in Bangkok. Echolink allowed local amateurs to relay information to concerned friends and relatives of those vacationing in the affected areas. For about a week, HS1WFK and others provided announcements on conditions in Thailand. In addition, the 40-meter net was able to be simulcast via Echolink to various nodes and repeaters around the world.

With radio propagation being difficult between hams in the affected areas and amateurs in the west, an impromptu network of public-service-minded hams created the Tsunami Relief Net on the Echolink system. The group organized shifts of operators around the world to handle the net control duties. The Tsunami Relief volunteers hoped their efforts on VHF and the internet would keep HF frequencies clear for communication out of the disaster area.

Satellites

In an effort to lend any assistance possible to the earthquake/tsunami disaster area, AO-51 was configured and opened for use as a store-and-forward message satellite for those in the disaster area. Two weeks after the disaster, AMSAT reported that members had not seen any traffic from the disaster area. However, the overall interest in the satellite PBBS has increased. In fact, there were three times the number of stations accessing the PBBS in the weeks after the disaster than there were before.

Clearly, the tool bag of the amateur radio emergency communicator is expanding. How many tools are in your emergency communications bag?

ter's disaster room and moved out and we are in fax communication with them now, passing info to the coordinating center. We have three stations out there and we are trying to connect lost people, pass info on displaced camps and people and the movement of food and essentials. We are trying to expand our coverage but our resources are limited. Sadly they, even our members, laughed when we wanted a disaster preparedness force. As recent as two months back, the government communications advisor refused to allow a foreign agency stationed here and ICRC to donate equipment when they wanted to upgrade. The Defense Ministry refused as they were out of band, which we said we would modify. Our role has to change as the situation changes. I am here at my desk with my land phone and mobile, a VHF radio, and HF radio constantly tuned to our disaster communications frequencies trying to coordinate as best as *I* can."

Northern Sumatra

As the death toll in Indonesia approached 130,000, amateur radio operators continued to supply emergency communications there as well. The Northern Sumatra city of Medulaboh is only 90 miles north of the earthquake epicenter, or about 100 miles southeast of the province's capital city, Banda Aceh. According to its mayor, one third of Meulaboh was destroyed. The only inter-city main road to Meulaboh from Banda Aceh and the southeast region was damaged. For three days the town had been isolated. The only access was by airplanes dropping supplies. Power, telecommunications, and water all were out—but ham radio still functioned.

Anto, YD6AT, in Banda Aceh sent out a distress call soon after the tsunami hit. The ARES station of Medan (the capital city of NS) established an 80-meter contact with YD6AT. According to Wyn Purwinto, AB2QV, a member of the local Military Amateur Radio Service from Lhokseumawe (a city on the east coast) established contact with Banda Aced through a linked VHF repeater. Zulkarman, YC6PLG, and Ady, YB6VK, relayed information between ham radio and the internet to concerned ham radio operators in Indonesia and overseas. Several medical teams with doctors who are hams were sent to Banda Aceh and Nias Island, about 350 miles east of the epicenter. Purwinto told *CQ* that it was expected that the large number of local and international journalists and the relief support teams would require additional amateur radio support.

Hams Travel with Relief Teams

As of mid-January we're aware of several amateurs traveling from the United States and Great Britain to the disaster area. Newly licensed ham Adam Steed, KE7EBX, from Lehi, Utah headed to Columbo, Sri Lanka to work with the International Red Cross. Doug McKay, KD7LRJ, said Steed hopes to be able to communicate via EchoLink with his family and members of the Utah ARES group while he is there. Steed's wife is going to try to obtain her amateur license while he is gone. McKay said the local club sent a completely configured and operational EchoLink station. The requirements seemed simple—a 12-volt power supply, a full-time internet connection, and a little configuration. Unfortunately, full-time internet con-

nections in Sri Lanka are not common. However, Kusal Epa, 4S7KE, was able to supply one. According to Epa, ham radio operators "do not have permission from the Telecom Regulatory Commission to set up internet-linked stations or repeaters in Sri Lanka. The RSSL has applied for this permission, and after exchanging a series of documents and many clarifications (usual red tape), the TRC has asked us to give them a demonstration." The licensing issues were still being worked on as we went to press. McKay e-mailed Epa to say, "When Adam leaves, we would like the EchoLink station and the other items he is bringing to be used by your club to keep in contact with Adam and with us and others around the world."

Two British radio amateurs flew to Sri Lanka in a bid to help in the aftermath of the tsunami/earthquake disaster. Malcolm Harwood, MØXAT, and John Baker, GØMTQ, carried vitally needed ham radio equipment and medical supplies donated by staff at the British Cattle Movement Service, where Malcolm's wife, Lily, works. Both hams will assist members of the Radio Society of Sri Lanka during a planned one-week stay.

In Summary . . .

"We will go one day at a time, because the task before us is awesome. How do you get into the mindset of such a disaster?" asked Victor Goonetilleke, 4S7VK. "The coastal lives of the people folded like a pack of cards in just a few minutes. The whole country is dazed and some people are so dazed that they don't realize they are. But then life must go on and every day we get a little stronger to meet the next dawn."

"News media representatives saw our service to the society in the hour of need through amateur radio," said Prasad. "I am also thankful to them in spreading the awareness amongst the public about amateur radio communication. The potential of amateur radio communication in bringing people together is thus established once again."

With Thanks

This story could not have been told without generous input from all of the amateur radio operators mentioned in this article. Your author is only a messenger. It is people like these who are serving in the public interest. We'll continue to monitor the story and bring additional news next month if conditions warrant. Are you prepared to serve when the call comes? Until next month . . .

73, Bob, WA3PZO

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SMARTTALK TUNERS vs. COUPLERS
First in a series from SGC

There is quite a bit of confusion about the difference between "antenna tuners" and "antenna couplers". Although the words are frequently used interchangeably, the products actually function very differently.

A **tuner** is installed at the output of the transceiver and tunes everything after it, including the feed line and the antenna. Its purpose is to match the feed line to the impedance required by the transceiver (usually 50 ohms). This means that it is also tuning the additional impedance of the feed line.

A **coupler** is installed at the feed point of the antenna. It matches the antenna to the impedance of the feed line (usually 50 ohms). The antenna is being tuned more efficiently, since the feed line is not being calculated into the tune. And, energy to your radiating element (the antenna) is being maximized.

Which is better? The antenna feed point is the optimum place to tune for maximum radiating efficiency. The 2003 Antenna Book, published by the ARRL states that "An antenna tuner does not alter the SWR on the transmission line going to the antenna. It only insures that the transmitter sees the 50 ohm load for which it was designed." [1] In short, a tuner works for the transceiver, while a coupler works for the antenna.

So which do you want? A tuner built into your rig is there to protect the transceiver, not to give you the best signal. It's convenient, simple, and at most HF frequencies, losses will be fairly small. However, by using a coupler, you will maximize the energy flow into the antenna, and minimize loss across the feed line to get the best possible signal.

Where does SGC fit in? The SGC Smartuner™ is a coupler that takes things a step further. With one antenna, it will typically tune better than 1.5 to 1 on any frequency in its range (1.8 to 30MHz, some to 60MHz). The Smartuner automates the tuning by measuring the SWR for you, finding the best possible match and storing the combination in memory for next time. And it does all of this independently, in less than 2 seconds, so you can **stop tuning and start talking.**

1 The ARRL Antenna Book, 20th Ed.; ARRL, 2003; p. 25-1

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Market Survey

Fully assembled (plus a few kits), all HF bands, from $550 to over $10,000! Gordo reviews your choices from bottom price to top, including a handy CQ buyer's guide chart.

High-Frequency Transceivers

BY GORDON WEST,* WB6NOA

Ham radio manufacturers continue to introduce completely new products to their broad lines of amateur radio equipment and accessories. These new entries are not warmed-over versions of existing rigs, but rather radical new designs with a focus on high-frequency receiver improvements, computer interfaces for digital modes, and most recently a rivalry between two manufacturers, which introduces the $10,000+ *ultimate* radio.

"Our customers are never disappointed when they come in to see what's new on the shelves," comments the sales staff at Ham Radio Outlet. "There are few large gaps in pricing, so we have a rig for almost any price budget." Mostly true—except for the big jump from $3000 to $10,000+!

"What we see and hear with the new line-up of HF transceivers are more receiver refinements," comments the sales team at KJI Electronics in New Jersey. "One hundred watts out is 100 watts out, but improvements in a digital tracking preselector let our customers hear more weak signals than they could with older equipment," adds the KJI sales gang.

Digital signal processing in the latest new transceivers has all but eliminated the hollow echoes of earlier DSP systems. Digital signal processing in the intermediate frequency stage may also allow Flash ROM updating of receiver function and performance by simply dialing up the factory and plugging in for a free RX boost.

Improved receiver mixers boost dynamic range while providing nearly automatic optimum settings to popular digital modes such as WinLink Pactor II and Pactor III plus ultra-narrow reception of PSK-31.

Change of Format

Our last buyer's guide for HF equipment (three years ago) covered equipment alphabetically by manufacturer name. This year we're summarizing HF equipment by street prices, starting at the lowest price and working up. We will emphasize new features found in new gear hitting your dealer's shelves last year and this year. You will see which products have been retired, and brand new products so fresh on the marketplace that all we can report are published specifications and a few minutes of hands-on experience at a recent hamfest.

The compact Alinco DX-70TH transceiver. (Photos courtesy of the radios' respective manufacturers)

Under $800

Alinco continues with its DX-70TH and DX-77T. Alinco's U.S. operation is now based in Texas, with ham radio veteran Russell Dudley as the new sales manager. Russell tells me he and his staff are all settled in with the new Alinco operation, and they offer full service out of their new Texas facility. Note their new address and contact information in the sidebar at the end of this article.

Elecraft adds digital signal processing to its K2 kit. In addition, the two- or four-band K1 HF kit transceivers

The Elecraft KX1 CW three-band, 4-watt kit.

**CQ Contributing Editor, 2414 College Dr., Costa Mesa, CA 92626*
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The ICOM IC-703 Plus replaces the original IC-703 for serious 10-watt output portable operation with an external backpack battery setup.

ICOM's IC-706MK IIG has a detachable head, includes DSP, and is multimode for all bands.

The MFJ-9020 twenty-meter CW transceiver shown here puts out 5 watts.

are an excellent way to get on the air for under $300. Elecraft has also introduced its KX1 CW three-band, 4-watt CW kit, also priced under $300. Elecraft makes kit building fun, even for first-timers. Yes, HF ham kit transceivers are still available!

ICOM offers the IC-703 Plus HF radio (replacing the original IC-703) for serious 10-watt output portable operation with an external backpack battery setup. It is the little brother of the popular IC-706 and shares many of the same features for under $550.

MFJ continues with its single-band, 12-watt, assembled HF transceivers (under $250), and now offers single-band CW transceivers with 5 watts out for under $190!

Ramsey still has stock of its QRP TX and RX kits, and the folks there say the amateur radio market is one of their favorites because it introduces new hams to their extensive line of high-technology test and hobby electronics.

Ranger, working over a CB line of equipment specifically tuned and tested for ham use, continues to offer 10- and 12-meter equipment, specifically *non*-modifiable to the 11-meter band.

SGC drops its combination ham and marine radio, the 2000, and continues to offer refinements to its 20-watt SG-2020 USA-built transceiver.

Sierra kits with 3 watts out continue to have a strong following among ham operators wishing to homebrew their own all-band HF transceivers.

Ten-Tec continues to come in under $800 with its 20-watt, all-band Argonaut, touting its capability for factory upgrades via the internet to continuously keep your Argonaut technically "fresh."

Yaesu adds 60 meters to the FT-817ND, plus now includes a nickel metal hydride (NiMH) battery and charger to add to this exciting portable transceiver with the onboard 1400-mAh battery inside.

Also, relatively new (since 2002) is the Yaesu FT-857D ultra-compact HF mobile transceiver with included digital signal processing, plus the head that may be removed for some unique mobile mounting configurations, seen selling for under $725.

$800 to $1500

The ICOM IC-706MK IIG *occasionally* was seen selling for

The SGC SG-2020 is a 20-watt, USA-built transceiver.

The ultra-compact Yaesu FT-857D includes DSP and a removable head.

Ten-Tec's Jupiter has 34 built-in IF-DSP receiver filters, plus software that is stored in Flash ROM. It can be run entirely from a personal computer.

The Kenwood TS-2000 includes HF plus 6 meters, 2 meters, 70 cm, and the ability to add 1.2 GHz (no 222 MHz).

under $800, but regularly is seen selling for just above $800 with continued popularity. It is now getting competition from the Yaesu 857, with Yaesu finally dropping its pace-setting FT-100D. However, ICOM "706ers" are heard everywhere on the bands, both HF mobile as well as base, and the rigs' performance on VHF and UHF is absolutely admirable for weak-signal VHF/UHF operators.

Leo at Kenwood says no change to the popular TS-570S, but they add to the line two versions of the relatively new TS-480—one unit featuring 100 watts out with built-in automatic antenna trimmer, and the other version having 200 watts output with no inside room left for any type of tuner. The 480's quad mixer, says Leo, can be compared to the receiver of the original TS-950. The head comes detached, making it an ideal HF plus 6-meter transceiver for the serious HF operator. Large alphanumeric LCD and back-lit keys make this a great mobile daytime and nighttime rig. Sorry—no 2-meter or 440 capabilities.

Ten-Tec continues in this class with the popular Jupiter with its 34 built-in IF-DSP receiver filters, plus software that is stored in Flash ROM. You can run the Jupiter entirely from your personal computer! Ten-Tec sells factory direct, and its sales personnel are all hams who are eager to correspond with you about any questions you may have on already-owned Ten-Tec equipment, or questions about new gear coming to the marketplace.

The relatively new Yaesu FT-897D is an amazing rig because it is 100-watt capable on 12 volts DC, yet can run all day at 30 watts out with a pair of built-in rechargeable batteries. Although the total 9-amp-hour NiMH battery system and specific-type charger adds up to an additional $300+, this battery-loaded heavyweight special puts you on all HF bands *plus* 6 meters, 2 meters, and 440 MHz, all bands multimode.

The small HF +6 +2 +440 radios ultimately caused the Kenwood TS-50 to go into a well-earned retirement. Keep in mind that the Kenwood TS-50 was the absolute smallest 100-watt HF transceiver to reign for nearly six years in a row!

Flex Radio now offers a complete software-defined, 100-watt transceiver capable of all bands and taking advantage of the utility of letting a laptop do most of the work. Stay tuned to Flex Radio and we'll see what type of software-defined radio it may bring to the marketplace soon. No advertised price yet, but equipment that is software-defined for most of its operation may be the next big development in HF ham radio equipment.

The big battle right at the $800 price mark will be between Yaesu's FT-857D and the ICOM IC-706MK II, both with detachable head, both including DSP, both with 100 watts on HF and 6 meters, 50 watts for each on 2 meters, and 20 watts for each on the 440 MHz band—both multimode for all bands. A recent holiday flyer saw both the 706 and the 857D battling it out for *a little above* $700. Many independent dealers across the country say *they* can't even buy these radios for this low price and are amazed to see their competition selling them in the $700 price range!

$1500 to $2500

Kenwood retires the TS-870 and replaces it with the TS-2000. This just-over $1500 rig includes HF plus 6 meters, 2 meters, 70 centimeters, and the ability to add 1.2 GHz. Sorry, no 222 MHz. The Kenwood 2000 can be ordered as a "silver box" designed for computer operation with the Kenwood ARCP-2000 radio control program, or suitable for mobile operation using the D-700 size RC-2000 mobile controller kit. It also may be ordered as a classic base station with the head permanently installed on the body. The TS-2000 includes IF DSP on the main band, audio frequency DSP on the sub-band, built-in HF antenna tuner, built-in keyer with three memories, high-stability TCXO for PSK operation, 290 alpha memories, and a built-in TNC so you can use it to monitor packet DX clusters. It is one amazing rig, and you need to get down to your local dealer to check it out!

ICOM continues with the IC-746 Pro HF/6m/2m transceiver for a little over $1300, and closes out the 756 Pro II covering all HF bands plus 6 meters, with the color high-resolution, 5-inch, thin-film-transistor color display. The Pro II's 32-bit floating-point DSP digitally transposes transmit and receive audio components to produce the desired audio frequency characteristics down in the IF stage, and noise reduction, notch filter, and PSN modulation and demodulation are also handled by the DSP circuit. Add a Heil microphone, and your transmit voice characteristics can be identified easily using the 756 Pro II. This monster-size rig does *not* have a built-in power supply, so get a 50-amp DC supply and you will be all set for terrific base-station results. Why is it being closed out? I'll tell you about the 756 Pro III in just a moment.

Yaesu offers the Mark V "Field" base station, which is the latest addition to its big line of FT-1000 monster stations. The Field builds in the AC supply, but you still have a rear jack to run it 12 volts in case of power outage. The Field also includes a built-in, high-speed automatic antenna trimmer capable of a wide assortment of matches between 15 ohms to 150 ohms, which is broader than most other sets with built-in tuners. I have seen the Field selling for under $1750, and this massive-size, 10-meter-through-160 transceiver with dual-receive and independent AGC systems must be operated to believe its receiver capabilities. A 10-pole Collins mechanical filter is also part of the Field package. I see the new Field and the ICOM 756 Pro II going head to head when hams are

www.cq-amateur-radio.com

HF Transceivers

Table 1. Under $800

Make/Model	DC or AC?	RX coverage	TX bands	Power Output (tested)	RX circuitry	Mem. Chs.	Remote Head	DSP?	Built-in Keyer?	Built-in Tuner?	"Street Price"
Alinco DX-70TH	DC	.15-30 MHz + 50 MHz	All HF + 6m	110	Dual conv.	100	Yes	No	No	No	$770
Alinco DX-77T	DC	.15-30 MHz	All HF	120	Dual	100	No	No	No	No	$699
Elecraft K1 (K1-2, K1-4)	DC	Ham band	2 & 4	5	Dual	VFO	n/a	No	Yes	Option	$269
Elecraft K2 Kit, DSP	DC or built-in battery	1.8-30 MHz	All HF	10	Dual	10	No	Yes	Yes	Option	$600
Elecraft KX1-CW	DC	40, 30, 20m	40, 30, 20m	CW, 4	Dual	VFO	n/a	Yes	Yes	Option	$279
ICOM IC-718	DC	30 kHz-30 MHz	All HF	100	n/a	101	No	Option	No	No	$569
ICOM IC-703 Plus	DC	.1-65 MHz	HF + 6m	10	Dual	105	Yes	Yes	Yes	External	$550
MFJ 9xxx series	DC	Ham band	Single banders for 80, 40, 20, 10m	12	Dual	VFO	No	No	No	No	$250 each
MFJ CWxxx series	DC	Ham band	Single banders for 40, 30, 20, 15m	5	Dual	VFO	No	No	No	No	$189 each
Ramsey QRP-RX	DC	Single banders for 20, 30, 40m	(Rcvr only)	n/a	n/a	—	No	No	No	No	$30/kit/band; $15 case+knobs
Ramsey QRP-TX	DC	(Xmtr only)	Single banders for 20, 30, 40m.	1 CW only	n/a	—	No	No	No	No	$30/kit/band, $15/case+knobs, $10 power supply
Ramsey SX-20	DC	20m.	20m.	10	n/a	n/a	No	No	No	No	$300 kit, $370 wired/tested
Ranger 5054DX-100	DC	50-54 MHz	6m.	100	Dual	10	No	No	No	No	$449
Ranger RCI-2950DX	DC	24.8-24.9, 28-30 MHz	12 & 10 m.	25	Dual	10	No	No	No	No	$400
Ranger RCI-2970	DC	28-30 MHz	10m.	100	Dual	10	No	No	No	No	$550
Ranger RCI-2980	DC	10m	10m	25	Dual	10	No	No	No	No	$449
Ranger RCI-2985DX	DC	10 & 12m	10 & 12m	25	Dual	10	No	No	No	No	$479
Ranger RCI-2995DX	DC	10 & 12m	10 & 12m	50	Dual	10	No	No	No	No	$550
Ranger RCI-6900	DC	10m	10m	25/50	Dual	10	No	No	No	No	$450
Ranger RCI-6300	DC	10m AM/FM	10m AM/FM	10/50	Dual	10	No	No	No	No	$400
SGC 2020 ADSP	DC or battery pack	1.8-30 MHz	All HF	20	Triple	20	No	Yes	No	No	$675
Sierra Kit	DC	1.8-30 MHz	All HF	3	Dual	—	No	No	No	No	$369
Ten-Tec Argonaut V	DC	.5-30 MHz	All HF	20	Dual	Software defined	No	Yes	Yes	Option	$795
Yaesu FT-817ND	DC or battery pack	.1-1000 MHz (no cellular)	All HF + 6/2m +70cm	5	Dual	208	n/a	No	Yes	External	$600
Yaesu FT-840	DC	.1-30 MHz	All HF	125	Dual	100	No	No	No	No	$559
Yaesu FT-857D	DC	.1-470 MHz	All HF + 6/2m +440 MHz	100	Dual	200	Yes	Yes	Yes	No	$700

Table 2. $800–$1500 Range

Make/Model	DC or AC?	RX coverage	TX bands	Power Output (tested)	RX circuitry	Mem. Chs.	Remote Head	DSP?	Built-in Keyer?	Built-in Tuner?	"Street Price"
ICOM IC-706 MkII-G	DC	.2-470 MHz	All HF + 6/2m + 70cm.	135	Dual conv.	100	Yes	Yes	Yes	No	$800
Kenwood TS-570D(G)	DC	.1-30 MHz	All HF	100	Dual	100	No	Yes	Yes	Yes	$919
Kenwood TS-570S(G)	DC	.1-54 MHz	All HF + 6m	100	Dual	100	No	Yes	Yes	Yes	$1099
Kenwood TS-480SAT	DC	.5-60 MHz	All HF + 6m	100	Dual	100	Yes	Yes	Yes	Yes	$969
Kenwood TS-480HX	DC	.5-60 MHz	All HF + 6m	200	Dual	100	Yes	Yes	Yes	No	$1080
Ten-Tec Jupiter	DC	.5-30 MHz	All HF	108	Triple	100 + computer	n/a	Yes	Yes	External	$1269
Yaesu FT-897D	DC or batteries	.1-470 MHz	All HF + 6/2m + 440 MHz	100	Dual	200 alpha	No	Yes	Yes	No	$850

Table 3. $1500–$2400 Range

Make/Model	DC or AC?	RX coverage	TX bands	Power Output (tested)	RX circuitry	Mem. Chs.	Remote Head	DSP?	Built-in Keyer?	Built-in Tuner?	"Street Price"
Flex Radio SDR-1000	DC	.1-65 MHz	HF + 6m	100	Dual	Software defined	n/a	Yes	Option	Option	Call
ICOM IC-746 Pro	DC	.3-60 / 108-174 MHz	All HF + 6/2m.	151	Triple conv.	100	No	Yes	Yes	Yes	$1350
JRC JST-245	DC	1.8-30 / 50-54 MHz	All HF+6m	180	Triple	200	No	No	Yes	Yes	$2500
Kenwood TS-2000*	DC	.1-500 MHz + 1200-1300 MHz	All HF + 6/2m + 70cm and 1.2 GHz option	HF 100	Quad	300 + computer	Yes	Yes	Yes	Yes	$1549
Yaesu FT-847	DC	.1-30/ 50-54/ 144-148/ 430-450 MHz	All HF + 6/2m + 70cm	119	Dual	100	No	Yes	Yes	No	$1600
Yaesu Mark V Field	AC/DC	.1-30 MHz	All HF	100	Triple	100	n/a	Advanced DSP	Yes	Yes	$1739
Yaesu 1000MP Mark-V	AC supply	.1-30 MHz	All HF	200	Triple	100	No	Yes	Yes	Yes	$2200

Table 4. Top of the Line ($2500+)

Make/Model	DC or AC?	RX coverage	TX bands	Power Output (tested)	RX circuitry	Mem. Chs.	Remote Head	DSP?	Built-in Keyer?	Built-in Tuner?	"Street Price"
ICOM IC-756 Pro III	DC	.2-200 MHz	All HF + 6/2m	100	Enhanced triple	100	n/a	Yes	Yes	Yes	$3000
ICOM IC-7800	AC	.1-60 MHz	All HF + 6m	200	Triple+	100+	n/a	Yes	Yes	Yes	$10,000
Signal One 1030E-DSP	DC	.1-60 MHz	All HF + 6m	200	Triple	100 + computer	Option	Yes	Yes	Yes	$14,500
Signal One 1030CI	AC	.1-30 MHz	All HF	200	Quad	100 + computer	n/a	Yes	Yes	Yes	$10,000
Ten-Tec Orion	DC	.5-30 MHz	All HF	100	Triple	Software defined	n/a	Yes	Yes	Yes	$3300
Yaesu FTDX-9000D	AC	.1-60 MHz	All HF + 6m	200	Triple	100	n/a	Ultra DSP	Yes	Yes	TBA
Yaesu FTDX-9000MP	ext. AC	.1-60 MHz	All HF +6m	400	Triple	100	n/a	Ultra DSP	Yes	Yes	TBA
Yaesu FTDX-9000 Contest	AC	.1-60 MHz	All HF + 6m	200	Triple	100+	n/a	Contest DSP	Yes	Yes	TBA

**Also available as a computer black box or mobile with small remote head.*

The ICOM IC-756 Pro III, replacing rthe Pro II, features improved distortion-free audio, high dynamic range and much more.

Ten-Tec's Orion HF transceiver with enhanced triple-conversion receiver allows you to monitor band activity in five selectable sweep ranges.

comparing features and affordability of a major-size base rig. Of course, Yaesu continues to market the FT-847 HF transceiver with its VHF/ UHF weak-signal capabilities. It is small but a delight to operate either mobile or base on either worldwide bands or tropo ducting on 2 meters and 432 MHz.

$2500 to $3500

ICOM's comment about its IC-756 Pro II—"You thought it couldn't get any better!"—leads to the new ICOM IC-756 Pro III. The Pro III offers improved distortion-free, high-dynamic range; major-size inductors in the band-pass filter stage to minimize smaller coil saturation; and low-distortion bandpass filter switching that the company claims is virtually immune to interference from foreign broadcast stations or AM broadcast station harmonics. ICOM also includes a new low-IMD roofing filter in the Pro III with less susceptibility to intermodulation distortion under strong signal conditions, plus a pre-amp that uses a set of bipolar transistors for higher gain when working the rig off relatively small dipole-type antennas. Also included is an 8-channel RTTY transmit memory and adjustable SSB transmit bandwidth. Oh, yeah . . . the programmable keyer now includes the new "@" CW character for sending your e-mail address over the air.

Ten-Tec offers the $3300 Orion HF transceiver with enhanced triple-conversion receiver. The Ten-Tec Orion uses *two* 32-bit, floating-point, DSP processors along with full dual-receive capability independent of where you have the other band tuned. Both receivers may be used simultaneously on the Orion, with bandwidth, AGC, pass-band tuning, and a host of other DSP options uniquely available for each band. The continuous real-time spectrum display allows monitoring of band activity in five selectable sweep ranges. This way you literally can see where the activity is on the band.

If you are into stereo, the new Ten-Tec Orion features a panoramic stereo receive feature which lets you hear the signals go from left ear to right ear as you pass through an on-the-air conversation. Nine adaptive DSP noise-reduction filters let you select Orion operating features. Ten-Tec products are manufactured in the U.S.A., and the company welcomes comments from the ham community about brand-new products or existing products in its ham radio and shortwave receiver line-up. Ten-Tec's website also contains a host of technical graphics aimed at better describing all that takes place within a Ten-Tec receiver.

The Stratosphere: Over $10,000

The big battle is on between ICOM and Yaesu for the ultimate $10,000+ ham transceiver. ICOM's entry is the new IC-7800 with 200 watts output, digital voice recorder, 7-inch color thin-film-transistor panoramic display, PSK-31 and RTTY demodulation (no computer needed, and you can plug in a keyboard to transmit), built-in tuner, spectrum scope, and a 110-dB dynamic range, plus 40-dB third-order intercept points on all HF bands, and a host of additional accessories to work this monster radio with your laptop or home computer system. Only one downside—discovering that after paying more than $10,000 for the radio, the microphone is not supplied! I bet this changes soon.

Yaesu's top-of-the-line radio is actually three different radios: the $10,000+ FT-DX9000 triplets. One version, the DX9000MP, offers 400 watts output on all HF bands plus plenty of power on 6 meters. The DX9000D offers 200 watts out and a slightly reconfigured information screen on the right

The ICOM IC-7800 is one of the new, ultimate, $10,000+ HF transceivers on the market and is packed with features.

The FT-DX9000D is one of Yaesu's "triplets" in the ultimate-rig category. It offers 200 watts out.

side of the equipment. There is also the DX9000 Contest, with enough metering on both left-hand and right-hand sides to satisfy any DXer or contester in action. The 200-watt versions build in the AC power supply, while the 400-watt output model uses an external AC supply. And when it comes to receiver performance, you can be assured Yaesu continues its reputation of offering the ultimate DX receiver in its price category.

When you consider that the price category for both the ICOM 7800 and the Yaesu 9000 is over $10,000+, you can be very well assured with either choice that you have landed the ultimate HF base station available today.

More Than Just Price

One final note is necessary: Manufacturers are well aware that this year may bring an announcement of limited HF privileges for entry-level ham operators. Manufacturers will be committed to holding price levels low and offering the valued dealer as much support as possible. Here is where the dealer comes into play for your buying decision, as many dealers may offer a lot more than just the lowest price for a specific piece of equipment.

Many dealers are extremely sensitive when low prices are mentioned in my reviews. These dealers raise a good point that there is more than just a low price involved in purchasing a new HF radio. Now that many new radios may take computer uploads, plus custom programming *and a variety* of accessories that the dealer may carry from after-market manufacturers, it's wise to work with your local dealer to explore the entire package as opposed to just the radio itself. I suggest that you buy from those dealers who spend the extra time with you to help plan your HF purchase and potential installation in a vehicle, RV, boat, or at home. Shop from a dealer who will take a sincere interest in getting you on the air with more than just the radio itself at the lowest price. If you need help, they will be there beyond just telling you how much the equipment is selling for.

However, if you know exactly what you are doing, which rig you want, and the accessories you'll need, indeed watch the incoming mail from the major ham radio suppliers. Just like the manufacturers, dealers are competing hard for your business with the very finest in amateur radio gear. Have fun making your selection! ■

Manufacturers' Contact Info

Alinco, distributed in North America by Ham Distribution, Inc., 15 South Trade Center Pkwy. #B5, Conroe, TX 77385 (telephone 936-271-3366; fax 936-271-3398; e-mail: <usrep@alinco.com>; web: <www.alinco.com/usa.html>)

Elecraft, P.O. Box 69, Aptos, CA 95001-0069 (telephone: 831-662-8345; e-mail: <sales@elecraft.com>; web: <www.elecraft.com>)

Emtech, 1127 Poindexter Ave. W., Bremerton, WA 98312 (telephone 360-405-6805; e-mail: <emtech@steadnet.com>; web: <http://emtech.steadynet.com>)

FlexRadio Systems, 8900 Marybank Dr., Austin, TX 78750 (telephone 512-250-8595; e-mail: <sales@flex-radio.com>; web: <www.flex-radio.com>)

ICOM America, Inc., 2380 116th Avenue NE, Bellevue, WA 98004 (telephone 425-454-8155; fax 425-454-1509; web: <www.icomamerica.com>)

Japan Radio Co., Ltd., 1021 SW Klickitat Way, D-101, Seattle, WA 98134 (telephone 206-654-5644; fax 206-654-7030; e-mail: <sales@jrcamerica.com>; web: <www.jrcamerica.com>)

Kenwood U.S.A. Corporation, Communications Division, Amateur Radio Products Group, 3975 Johns Creek Court, Suwanee, GA 30024-1265 (telephone 310-639-4200; fax 310-537-8235; web: <www.kenwood.net>)

MFJ Enterprises, Inc., P.O. Box 494, Mississippi State, MS 39762, (telephone 662-323-5869; fax 662-323-6551; e-mail: <mfjcustserv@mfjenterprises.com>; web: <www.mfjenterprises.com>)

Oak Hills Research, 10691 E. Bethany Drive, Suite 800, Aurora, CO 80014 (telephone 303-752-3382; fax 303-745-6792; e-mail: <qrp@ohr.com>; web: <www.ohr.com>)

Ramsey Electronics, 590 Fishers Station Drive, Victor, NY 14564 (telephone 800-446-2292; fax 585-924-4886; e-mail: <sales@ramseymail.com>; web: <www.ramseyelectronics.com>)

Ranger Communications, Inc., 401 W. 35th Street, National City, CA 91950 (telephone 619-426-3199; fax 619-426-3788; e-mail: <sales@rangerusa.com>; web: <www.rangerusa.com>)

Red Hot Radio – No information available

SGC, Inc., 13737 WE 26th Street, Bellevue, WA 98005 (telephone: 425-746-6310; fax 425-746-6384; e-mail: <sgc@sgcworld. com>; web: <www.sgcworld.com>)

Small Wonder Labs, 32 Mountain Road, Colchester, CT 06415 (e-mail: <dave@smallwonderlabs.com<; web: <www.smallwonderlabs.com>)

Ten-Tec, Inc., 1185 Dolly Parton Parkway, Sevierville, TN 37862 (telephone 865-453-7172; fax 865-428-4483; e-mail: <sales@tentec.com>; web: <www.tentec.com>)

Vintage Radios of North East Texas – No information available

Wilderness Radio, P.O. Box 3422, Joplin, MO 64803-3422 (telephone 417-782-1397; e-mail: <qrpbob@leapmail.net>; web: <www.fix.net/~jparker/wild.htm>)

Yaesu (Vertex Standard USA), 10900 Walker Street, Cypress, CA 90630 (telephone 714-827-7600; e-mail: <customerservice@vxstdusa.com>; web: <www.yaesu.com>)

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Results of the 2004 CQ WW WPX CW Contest

BY STEVE MERCHANT,* K6AW

Conditions for the 2004 CQ WPX CW Contest were quite good in most parts of the world. The number of logs received was up 10%, and just like last year's record-setting scores, there were 13 new world and continental records set. Also just like last year, D4B established another world record in the Single Operator, All Band (SOAB) category.

DX

From Cape Verde, Al, 4L5A, operated D4B to again take the top SOAB spot with over 16.5 million points, almost three million ahead of the number two finisher, 3V8BB (Hrane, YT1AD op). Third place went to Jose, CT1BOH, operating CS3B, followed by fourth place OC4WW, operated by Olli, OHØXX. Aruba again registered a top ten entry with John, W6LD, operating as P40L for a fifth place finish. Sixth place went to ZF1A (John, K6AM op), and seventh place was taken by Tom, W2SC, operating his fine 8P5A station in the low-power category. Eighth place was won by VY2TT (Ken, K6LA op). Sergei, MØSDX, took ninth place and set a new European record as GI1A, and PJ2W (Jim, WI9WI op) completed the top ten.

The 10-meter category was won by AYØF operated by Fabian, LU2FM. Second place went to PS2E (Eger, PY2EX op), with Jan, 4X1VF, in third, UUØA (Yuri, UUØJX op) fourth, and low-power Matija, 9A3VM, in fifth place. On 15 meters it was PT5A (Eric, PY2EMC op) setting a new South American record and winning by a large margin. PX2B operated by Alex, PY2WB, was second and Jesus, LU5FC, took third place. Low-power entries from 5I3A (Mike, DL4SM op) and 9M8DX (David, VK6DI op) took fourth and fifth place, respectively.

Twenty meters was won handily by Vaho, 4L8A, who set a new Asia continental record. Nikola, 9A5W, was in second place and set a new European record, followed by John, N2NC, at N2RM, who also set a new USA record on this band. Fourth place was won by Mark, 9A8A, and fifth place was taken by Bill, K1GQ, operating KC1XX. On 40 meters, IG9B (Simone, IV3NVN op) took first place and set a new Africa record, easily beating Krzysztof, SN7Q, who nonetheless set a new Europe record. Third place was won by Tom, K1KI, operating KG1D. Fourth was David, VO1AU, and IU3X (Andrea, IV3SKB op) took fifth place.

The 80-meter winner was Robert, S57AW, with a decisive first-place lead and a new European record over second-place YR2I (Orza, YO2DFA op). Andy, ZC4/G3AB, was third, Laimon, YL2PQ, fourth, and YL9W fifth. Bela, HA8BE, set a new European record on 160 meters, followed closely by Algis, LY2BW, in second and Bojan, S57M, third. Jonas, LY5A, and Oleg, USØZZ, were the fourth and fifth place finishers, both low-power entries.

This is Ranko, YT6A, the number two Single Op, All Band station in Europe.

The world low-power SOAB winner was Tom, W2SC, operating 8P5A. Second place went to Con, DF4SA, operating 9H3MM. Third was Joel, KG6DX, operating as NH2DX, only slightly over 20,000 points ahead of his fourth-place competitor, Nikolai, UN7MO. Right behind him in fifth place was Igor, UA4FER, and sixth place winner was Adrian, YO3APJ. Seventh place went to Anatoly, RW3GB, and eighth was EM3H operated by Alex, UR3HC. Ninth place was won by John, KK9A, and tenth was Heinrich, DL2OBF.

Matija, 9A3VM, won the low-power 10-meter category with a big lead over HA1ZZ in second place and NA4W (Cort, K4WI op) third. IR8C (Francesco, IZ8EQF op) was fourth and Badza, YU1FG, fifth. On 15 meters low-power Mike, DL4SM, took first place as 5I3A, followed by 9M8DX operated by David, VK6DXI, in second and Igor, 4Z5FW, third. Goran, 9A6C, was fourth, and fifth place went to Roman, URØMC. The first place 20-meter low-power score was made by Igor, Z32ID, operating as Z37M. Second was Javier, LU5FF. Third place went to LY9A (Gedas, LY3BA op), and fourth was Vlad, RU3HD. Jovica, T94FC, was in fifth place. The 40-meter low-power winner was 4XØX, operated by Zakhar, 4Z5AX, followed very closely by Fazil, TA3DD, in second and T9/9A5AX (Emil, T99W op) third. HG8I took fourth place, and Vinko, S53F, was fifth. Eighty meters was won by 4N600A (Acim, YU1YV op), with S5047L (Janko, S57L op) in second, and Stan, SP9XCN third. LY3CW took fourth place, and Ros, 4Z5LA, fifth. The 160-meter low-power category was won by Jonas, LY5A, with Oleg, USØZZ, in second. OL6T (Lada, OK1DCF op) was third. Leon, UX5NQ, was fourth place, and fifth place was taken by Alex, UT1FA.

The Tribander/Single-Element category was won by Ricardo, CT3KN, who was a little over a million points ahead of second-place TI3M (Marco, TI3TLS op). Alex, RA9SG, was third, Con, DF4SA, was fourth as 9H3MM (low power), and HG8R was fifth. AN5FV was sixth, and ISØ/S52A (Franc, S59AA op) took seventh place. Don, G3XTT, was in eighth place, Richard, 9M2/G4ZFE, in ninth, and Alex, RZ3AZ, tenth. The 10-meter winner in the TS category was Badza, YU1FG. The 15-meter winner was Harry, DK2GZ, followed by low-power entries from Hubert, S51NZ, second and Bob, WA1FCN, in third place. Twenty meters was won by KW5DX (Lee, K1NT op), followed by Jim, K9WIE, operating KØCAT in second, and Mike, RA6DB, third. On 40 meters Jun, JH4RHF, operated 4U1VIC, demolishing all competition to take first place. Vlad, RU4CO, was second, and Alex, YL2RR, was third. On 80 meters Martin, OK1RR, was the winner, with Al, EU1AZ, second, and Dave, NT6K, third. The 160-meter winner was low-power Oleg, RN3CT.

The Rookie category winner was low-power entrant Andy, US6IMA, followed by another low-power entry from Andris, YL3GCU. Randy, W6SJ, was third, Dave, EI7JK, fourth (low power), and Bob, KR4M, in fifth place.

Single-Op Assisted was narrowly won by Yuri, UA9AM, operating RG9A. He was followed by second place winner George, JY9QJ. Chas, K3WW was third, Rick, KI1G, fourth, and Slavko, S57DX fifth. The 10-meter Assisted winner was Grant, K4GM, operating as KW4CW. On 15 meters Juhan, ES5QX, won easily, followed by Jarno, OH6NJ, and Claudio, LU7DW as LS7D, in third. On 20 meters UZ8M (Alex, USØMR op) won, followed by OH8L (OH8LQ op) and Alex, EW2AA, in third. The 40-meter top spot in SO(A) Assisted went to Vytas, LY2IC, with Michael, DL1HCM, in second. Andrzej, SP8BRQ, won 80 meters, with Venci, Z32AF, second and Juan, EA5FID, third. 4N200A (Ivan, YU1UA op) won the 160 spot in this category.

The top QRP spot was won by Bosko, YT7TY, followed very closely by TI5N (Bill, W8QZA op) in second place. OT4A (Kaz, JK3GAD op) was third, with Milan, OK1IF, at OL4W fourth and SM3C (Bengt, SM5CCT op) fifth. Hiro, JR3RWB, was the top 10-meter op. Edward, SP9H, won on 15 meters, and Miki, YT1CS, easily won 20 meters. Jan, OK1IR, was the 40-meter champion, and Vlad, RA3XAR, won on 80 meters. ON4AEB was the 160 meter winner.

USA

Frequent winner Bob, KQ2M, again won the top SOAB USA spot. He was followed very closely by Pat, N9RV, as KW9N, who put in an impressive performance from the USA's "black hole." KC3R (Alex, LZ4AX op) was third, KN1DX (Ken, K4ZW op) was fourth, and Ted, KT1V, was fifth. Scott, W4PA, operated KK4TT

*e-mail: <k6aw@cqwpx.com>

DF4SA at 9H3MM recovered from a heavy storm and broken rotor to finish second in the SOAB Low Power category.

for a sixth place win. Fred, K3ZO, was seventh. Bud, AA3B, was in eighth place, Carl, AI6V (at K6IDX), was ninth, and Jim, N3BB, operated NT5C for a tenth place finish.

Richard, K5NA, drove NN5AA to the top 10-meter spot, followed by Bob, N4BP, as NU4BP. The remaining spots went to low-power entries from NA4W (Cort, K4WI op) in third, Ed, KN4Y, in fourth, and Bob, NX5M, in fifth place. On 15 meters John, K4OAQ, won handily. Second place went to Bert, K2BA, followed by Ken, K1UM, and low-power Marv, N5AW. Bob, WA1FCN, was fifth. Twenty meters was decisively won by John, N2NC, at N2RM, with Bill, K1GQ, operating KC1XX in second place. Jim, N9TK, was third, Doug, W9WI, fourth, and Lynn, W5FO, fifth. On 40 meters frequent winner and record holder Tom, K1KI, won as KG1D. NK4A (Paul, N4PN op) was second and Steve, W3BGN was third. Tom, NI1N, was fourth and Nikola, AC6DD, fifth. The 80-meter winner was Al, W1FJ, with Bruce, K6OY, in second. Bill, WA5VGI/6, was in third place, with Dave, NT6K, fourth, and low-power Redd, WB2DVU, fifth.

John, KK9A, won the US SOAB low-power title, followed by Merrill, WK2G, in second, Terry, N4TZ, as KS9K in third, Ed, N1UR, operating NV1N was fourth, and fifth place went to Carol, N2MM. Cort, K4WI, operating NA4W was the 10-meter winner, with Ed, KN4Y second and Bob, NX5M third. Fifteen meters was won by Marv, N5AW, with Bob, WA1FCN, second, and Gheorghe, N2GM, third. John, K9QVB, was the top 20-meter low-power entry, followed very closely by Bob, K8IA. Tom, KV8Q, was third. Forty meters was won by Yuri, K3BU, as NT1E, with Bill, N4NX, second, and Dave, K4SV, third. Redd, WB2DVU, won the 80-meter spot, with Peter, W2CDO, second and Jim, K5RX, third.

Michael, N2GC, won the US T/S category, followed by John, K4BAI, in second place, Terry, N6CW, third, Ben, N3UM, fourth, and

Expanded Results

The list of multi station operators and expanded QRM can be found on the CQ website, <www.cq-amateur-radio.com>, in the contests section under "Expanded Results 2004 CQ WW WPX CW Contest."

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The view toward Europe from the 40-meter beam of the KG1D station operated by Tom, K1KI. Tom was tops in North America and third overall on 40 meters. You can almost see Europe on the horizon!

low-power entrant Ann, WA1S, in fifth place. WA1S and Alex, WB2AA, were the top two low-power winners in T/S category, followed by Arnie, N6HC, WR1TE (Mike, W1JQ op), and Paul, WN6K. Randy, W6SJ, won the Rookie top spot, with Bob, KR4M, in second place, and Dmytro, KY2T, in third.

Single-Op Assisted top honors went to Chas, K3WW, with second place going to Rick, KI1G. Third place went to W1US (Krassy, K1LZ op), followed by Steve, N8BJQ, and Darrell, AB2E. KW4CW (N4GM op) had the top 10-meter score, as did NT5TU on 20 meters and AA4VV on 40, all three low-power entries..

The USA QRP winners were Gary, N7IR, in first place, with Barrett, KE4R, second, followed by Roger, W8VE, Chris, KA1LMR, and Ken, WA8REI. Single-band winners were Bruce, W1CVE, on 15 meters, Jim, W6YJ, on 20, and George, N2JNZ, on 40.

Multi-Ops

The Multi-Single category was won this time by P40O, operated by LY2CY and LY2TA. PS2T (operated by PY2YU, PY2NDX, YU1RL, and PY2NA) came in second. VQ5V was third and RT9W was fourth. ED6IB scored fifth, with UA9AYA in sixth place, OM7M seventh, RW9C eighth, T93M ninth, and RL3A finishing up in the tenth spot.

The ops at NO2R (NO2R, K2TW, and K2NG) won the top USA Multi-Single award. Second place again went to NO5W with ops NO5W, N1LN, K5GN, N5RP, NT5TU, K5GA, and K5NZ. Third place was claimed by W4ML, operated by Bob, W4MYA. Fourth position went to NZ1U and in fifth place was KX7M.

In the Multi-Two (M2) category PJ4U was the winner, operated by YL2KL, YL2GM, YL2GQT, YL2VW, and YL3GE (K7GEX). Second place and a new USA record went to the team at the K4JA superstation, with operators K3TW, K4JA, K4ZA, K7SV, KD4D, N4GG, W3BP, and W4TNX. RU1A (ops RU1AA, RW1AC, RV1AW, UA1ARX, RA1AR, and UA1AKC) was third. UU7J was fourth and WE4OJ took fifth place.

The overwhelming US M2 winner was KM4M (K4JA). Second place honors went to WE4OJ and ops K5KG, WD4AHZ, W4IX, W4SAA, and K1TO.

The Multi-Multi category was decisively won by the team at A61AJ, with operators A61AJ, G3SXW, JE1CKA, K1ZZ, K3EST, ON5NT, PY5EG, S50A, S53R, SMØCXU, W6OAT, and W6OSP. Second place went to DL8WPX (at DFØCG) and operators DK7YY, DL1MGB, DL3DXX, DL5AXX, DL5LYM, DL6FBL, DL8DYL, DL8WPX, DL9DRA, and DO2WW. the third spot went to LZ9W (ops LZ1ANA, LZ1PM, LZ1UQ, LZ1ZD, LZ1PJ, LZ2CJ, LZ2FV, LZ2HM, LZ2PO, LZ2UU, LZ3UM, and LZ5VK.

In the U.S., NY4A took first place Multi-Multi, operated by K2AV, K4QPL, N4AF, W2CS, and WJ9B. Second place went to NN5J, operated by KØVBU, K5ALU, K5DB, K5GO, K5LG, KM5G, NØEHW, N5DX, N5OT, N5XR, and WØJOE. NG3U was third.

Club Scores

The top combined SSB and CW Club Score was earned by the Bavarian Contest Club, and the number two club was the Potomac Valley Radio Club. Congratulations to both groups for all their hard work!

Log-Processing Info and Credits

Please do not rely on your logging program to get the Cabrillo header filled out correctly, especially if you are entering one of the categories that requires a Category Overlay line in the header. If you make any changes to your Cabrillo file, please use a simple text editor, not a word processor. See the 2005 rules in the February issue of *CQ* or on the CQ website

Visit Our Web Site

(www.cq-amateur-radio.com), or the WPX website (www.cqwpx.com) for more information. There are important updates to the rules regarding submission of Cabrillo logs: Only your callsign is required in the "Subject:" line of the e-mail you send the log with. Also, USA stations are requested to include their ARRL Section in the header of their Cabrillo log file.

Special thanks go to the many operators who travel to remote locations all over the world so the rest of us have interesting and exciting prefixes to work. Also, we thank the many operators who arrange for special prefixes solely for use in this contest.

Thanks to WT4I for his log-checking software, and to EA3DU and OH5DX for help handling logs from their respective countries. Many thanks also to members of the CQWW Contest Committee for helping with various log-handling issues in local languages. Thanks as well to N5KO and his robots; they are a huge help in the log-checking process.

We are checking serial numbers. If we receive a log without sent or received serial numbers it will be reclassified as a checklog. If you encounter problems with serial numbers in your log, please take the matter up with your logging program author, as with close to 5000 logs to process each year it's impossible for us to fix everyone's log.

The biggest thanks go to Steve Bolia, N8BJQ. He has been tireless in his efforts and is always ready to step in to help with the CQ WPX Contest.

We Need Pictures!

Please send photos of your contest operations so we might share them in our write-ups. It doesn't need to be a photo of a 16-person multi-multi effort at an exotic location. We just want reproducible shots, preferably color and digital, of you or your station or both during the CQ WPX Contest. You can submit photos as attachments to your Cabrilllo logs.

2005 Dates

The 2005 WPX SSB Contest will be held on March 26–27, and the CW contest will be held on May 28–29. Please plan to participate. Rules can be found both on the *CQ* magazine website and the WPX website. We request that logs be submitted by e-mail in Cabrillo format. Send CW logs to <cw@cqwpx.com>. They also may be snail-mailed to CQ WPX Contest, 25 Newbridge Road, Hicksville, NY 11801.

See you in the contest!

73, Steve, K6AW

USA QRM

Operating a CW contest 13 days after major surgery is probably not the smartest action, but it was fun to be in the hunt a little. Couldn't operate late on 40 when condx were best due to the recovery process, but maybe next year! . . . **AA7FK.** Wife's workin and I'm contestin. Life is good. . . . **AI3Q.** Forty meters was great this year. I will try QRP next year. . . . **K4SV.** First ever contest using Writelog. Works very well! . . . **K5MA.** Had fun while it lasted. QRP is a blast! Love the Yaesu FT-817. . . . **K9GY.** Very poor band conditions, but CW ops will always be there! . . . **K9WWT.** Great fun. Used a bent dipole antenna in my attic. Highlights working OK1RI and D4B on 40m. . . . **KG4HTT.** Good conditions and fine operators made this one a pleasure. Thanks to everyone who copied my long call and slow fist. . . . **KG6HAF.** Nothing like the challenge of storm clouds with QRN crashing

(Continued on page 103)

TECH TALK *If you can't hear 'em, you can't work 'em!*

Whether DXing from the home QTH, operating portable or communicating while mobile, the classic expression of "If you can't hear 'em, you can't work 'em" always reigns supreme. That philosophy was also a special design consideration in Icom's development of the incredibly popular IC-706MKIIG transceiver. In particular, Icom focused on three interrelated areas: receiver sensitivity, selectivity, and noise reduction. This Tech Talk overviews those areas.

SENSITIVITY. The first and foremost requirement for top-notch receiver performance is high "front end" sensitivity with a low noise floor and wide dynamic range. Realizing that fact, the IC-706MKIIG's most important first mixer stage employs double balanced inputs and outputs for both weak signal amplification and common mode reduction of extraneous noise. The design concept here is simple but most effective: boost signals more than noise and you can hear what others miss!

IC-706MKIIG

Since signal levels vary from day-to-day and band-to-band, the IC-706MKIIG's panel-selectable receive preamp and attenuator also let you step up or reduce front end gain to fit needs at the particular time. This overall combination yields the unique ability to "pull weak stations out of the mud" and it is amazing! Even with a dual balanced first mixer and panel-selectable RF preamp and attenuator, weaker signals can still become masked by external noises. That is no problem for an IC-706MKIIG however. The transceiver's built-in noise blanker stops intermittent/pulse-type noise while its built-in DSP system reduces constant/band-type noise to noticeably improve copy under all conditions.

SELECTIVITY. Equally important for copying signals of all types and levels is sharp IF filtering. Icom's IC-706MKIIG really stands tall here, as its standard/included SSB filter is wide enough to yield full-bodied audio yet steep-skirted enough to cut QRM like a knife. Lacking such steep-skirted selectivity, strong signals can "blast through" or appear to widen a filter's bandwidth, and reducing receiver sensitivity is necessary to avoid that scenario. Comparatively, the standard/included SSB filter in '706MKIIG exhibits a better average signal or –6dB to strong signal or –60dB shaping factor than optional "SSB Narrow" filters from some other manufacturers. Surprising? Not really. Icom always delivers top performance in amateur radio gear!

HEARING IS BELIEVING! Thinking about a new transceiver for home, portable or mobile use? Great idea! Before selecting a particular rig however, remember to compare vital specs. Notice the IC-706MKIIG is first class in sensitivity (0.15µVin the 1.8 to 30MHz range) and selectivity (2.4kHz at the –6dB level, widening to only 4.8 kHz at the strong signal/-60dB level). Factor in initial cost or investment, years of enjoyable use, and later resale/trade value and you will agree that the IC-706MKIIG is today's best buy in an ultra compact transceiver!

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A new convert to CW, AD9T found that the keyer paddles he wanted were out of his price range . . . until he worked out a way to build his own base using a little-known material called "densified wood," along with do-it-yourself molten lead!

Build a "Wood" Base for Keyer Paddles

BY JEFF BURNS,* AD9T

When I first became interested in amateur radio, 13 and 20 word-per-minute code speeds were still required for access to most of the HF bands. Consequently, I resigned myself to activities above 50 MHz. Fortunately, though, the code-speed requirement was lowered to 5 wpm before I had a chance to buy a radio, so I decided to try to pass that test and get on HF. After a lot of hard work I just barely passed, and I had no intention of ever doing anything more with Morse code.

For my first radio I decided to build an Elecraft K2. I thought it would be fun to build a kit, and I liked the K2's small size. I planned to use it only on SSB, but when I saw all of the rig's great CW features, I became interested in at least trying CW. That interest was spurred by my home situation. I set up my shack in the extra bedroom and soon discovered a problem. With a new baby in the house, my only chance to operate was when the baby was asleep, and my wife would take advantage of those opportunities to catch up on her sleep as well. Every time I spoke into the microphone, I risked waking someone. CW was the obvious solution. Now I just needed a paddle or a key.

An Affordable Paddle

I posted a message on the Elecraft e-mail reflector asking for advice on what paddle I should get. I received an overwhelming number of responses highlighting the good and bad points of various models. Schurr paddles (available from Morse Express; see Resources) stood out from the others because no one on the list had anything bad to say about them—except the cost. The lowest cost Schurr paddle is the Einbau Wabbler. It is the same as the Portable Wabbler, but without the base, dust cover, and cable, and it cost $100 less. I was confident I could make a base, so I bought the Einbau Wabbler.

Densified Wood

For the base I used a piece of densified, or impregnated, wood laminate. It is

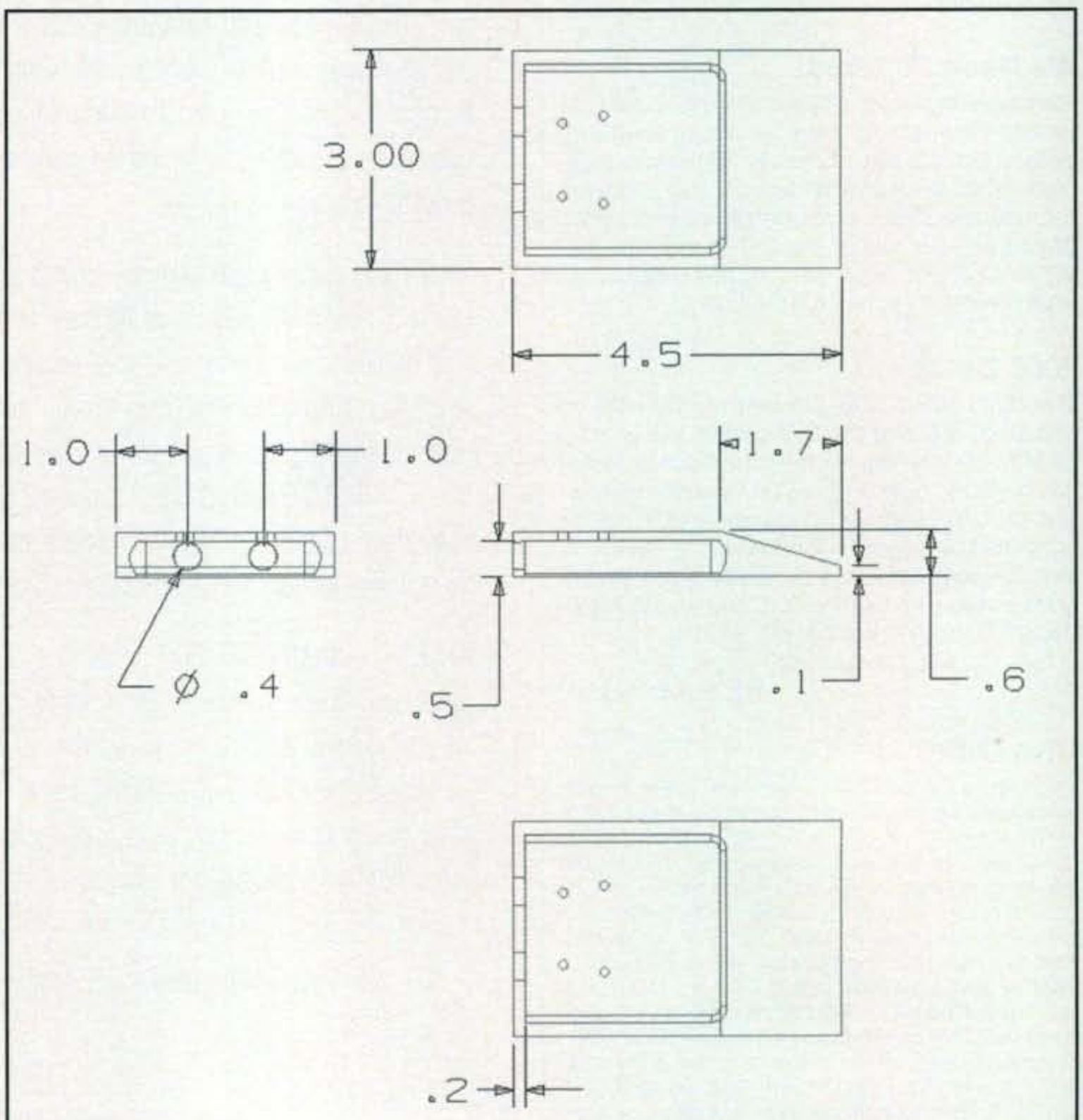

Fig. 1– Dimensions for cutting the paddle base from densified wood.

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Shows radiated antenna relative field strength. Determine radiation pattern. **MFJ-802** has huge 3 inch meter. Telescoping dipole reduces influence of surrounding objects and is more reliable, repeatable than monopole. Sensitivity control. Jack for remote sensor, MFJ-802R, $24.95.

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Display *Remote Sensor*

You're ragchewing with a G3 in England . . . *"Temperature outside is a cool 53 degrees with falling barometric pressure -- looks like a rainstorm may be coming. Humidity here is 73%."* . . . while noticing it's 1900 hours GMT.

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MFJ CW Reader/Keyer

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Photo A– A densified wood base after cutting but before polishing. The two holes toward the front are for mounting screws, which also ground the frame of the paddle to the lead in the base. The two screws toward the back are for the wires to the left and right paddles. (Photos by the author)

commonly used for items such as knife handles and faucet knobs. I had discovered this material a few years ago and even visited one of the factories where it is made. The first step in making impregnated wood is to soak wood veneers in a pressure bath of phenolic resin. The impregnated veneers are then stacked in a large press and compressed. Heat is then applied to cure the resin. The resulting material looks very much like natural wood but is much harder and denser.

The phenolic resin adds resistance to water and chemicals, but also makes the material much more brittle than untreated wood. Densified wood is nearly impossible to cut with a knife or a saw blade designed for wood. However, tools designed for cutting metal, such as carbide-tipped woodworking tools, work well. Nearly any type of sanding tool also works. The dust created when this stuff is cut is intense, so I highly recommend that you use a tool with a dust collector.

Machining the Base

To make the base, I started with a piece of material just over 1/2 inch thick. A raw panel of densified wood has a slightly uneven outer surface with a thin glaze of phenolic resin. I sanded both sides of the blank stock smooth and parallel using a sanding surfacer (which is similar to a thickness planer, but uses a sanding drum instead of knives). If such a machine is not available, I suggest asking the manufacturer to surface the stock for you at the factory. Next I cut out two bases on my table saw—just in case I messed up one of them (see fig. 1 for dimensions). Since my father-in-law has a milling machine, I used it to square all the sides and cut the angle on the front. A table saw could have been used, but would have required more care (see photo A).

Filling with Lead

Densified wood on its own is not quite heavy enough to serve as a steady paddle base, so I hollowed out the bottom with a router and filled it with lead. Based on previous experience with densified wood, I left at least 1/8 inch of material on all sides. Short end-grain sections, such as the back wall, are especially likely to break.

I drilled the two holes for the connectors before hollowing the cavity, because the wall would then be too thin to support the stress of drilling. I then installed stainless-steel nuts and bolts in the appropriate locations for mounting the paddle. I chose stainless steel because molten lead would not stick to it. This allowed the bolt to be retracted after the lead hardened, leaving the nut embedded in the lead.

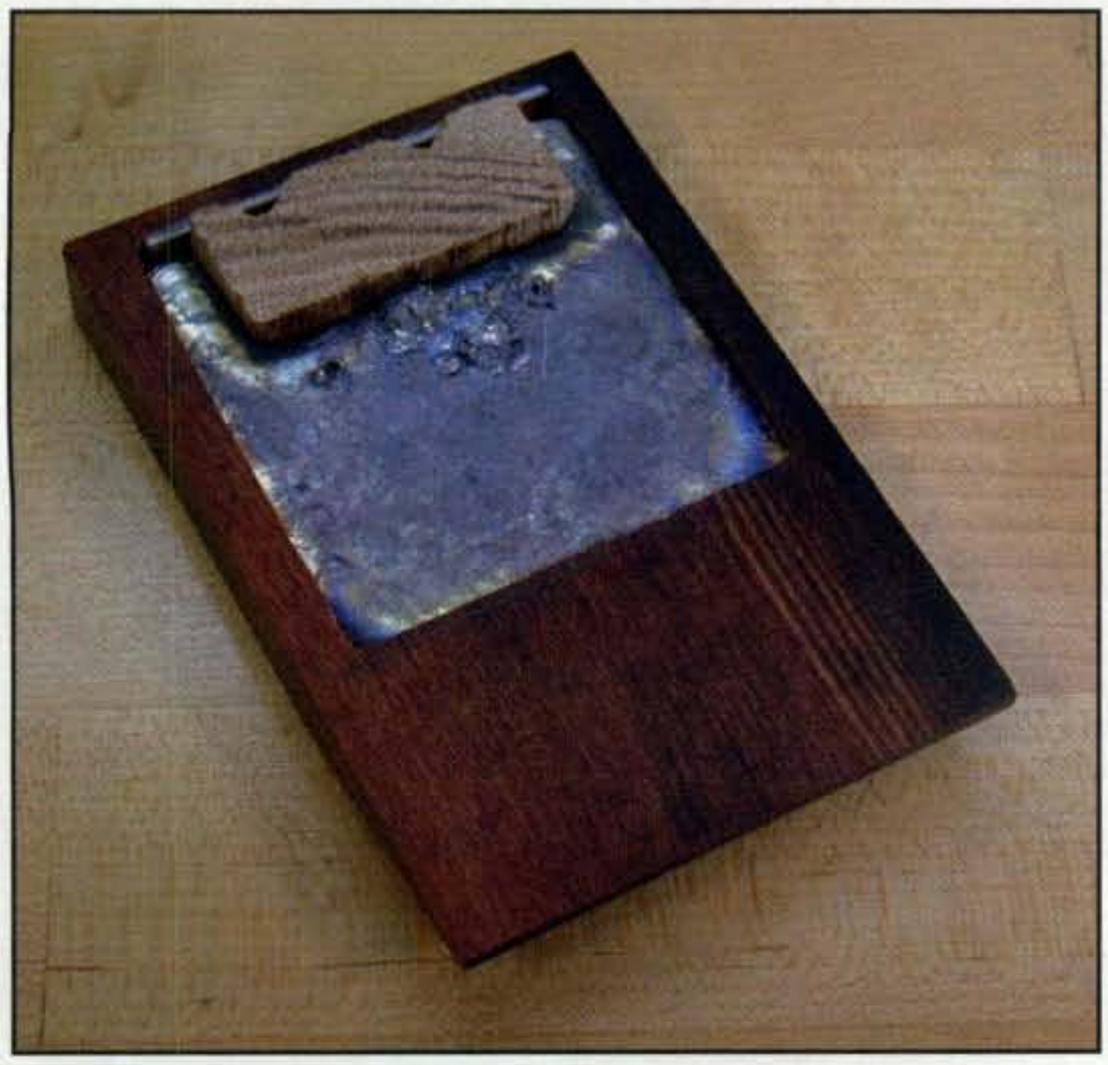

Photo B– Bottom of the second base after the lead has been poured in. Note the wood block that forms a cavity for connecting the wires.

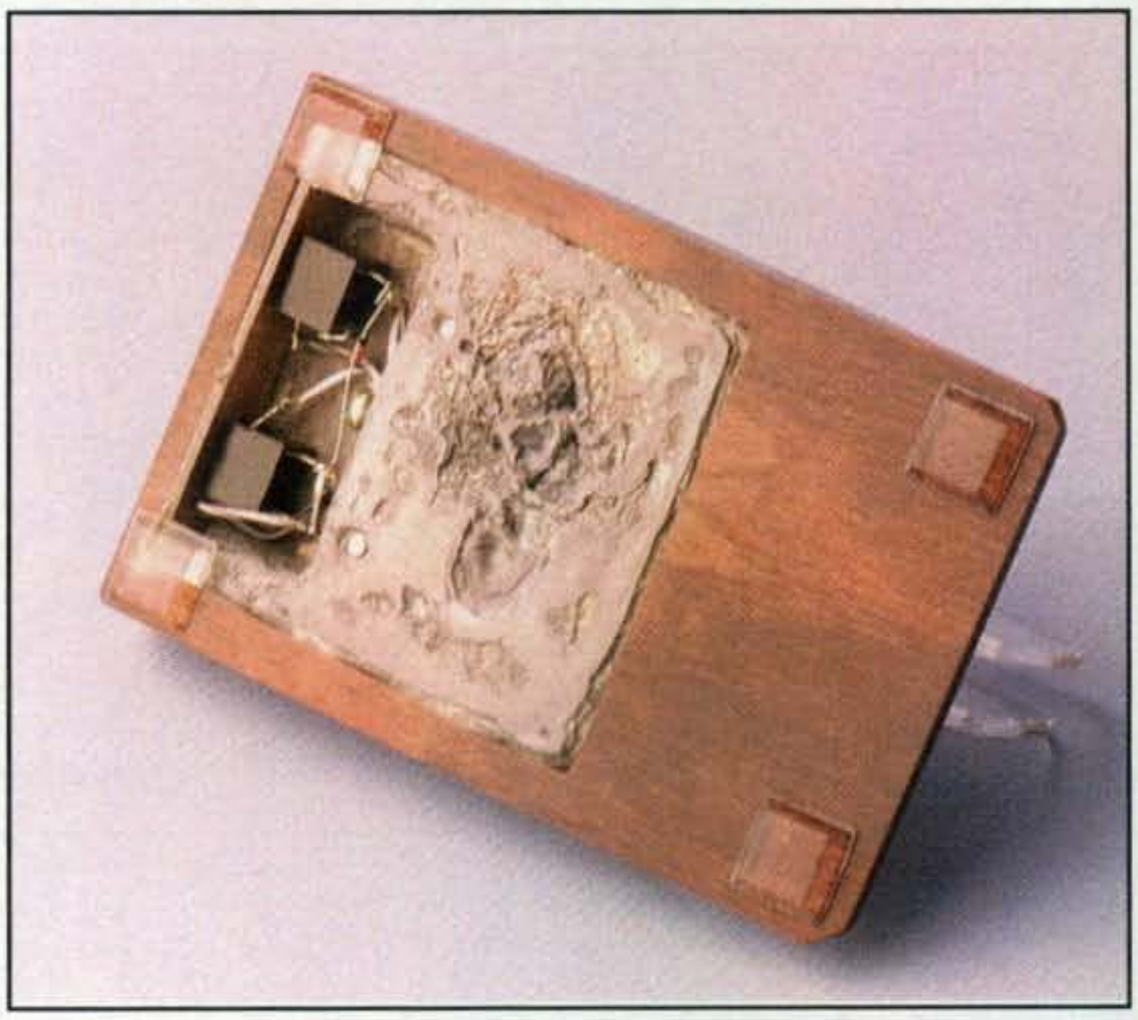

Photo C–The lead in the first base hardened up rough and ugly because a bubble formed on pouring and because the slag was not removed before pouring. Note that the jacks are mounted to a piece of circuit board in the base cavity. The diodes allow a straight key to be connected to the Elecraft K2 at the same time as the paddles.

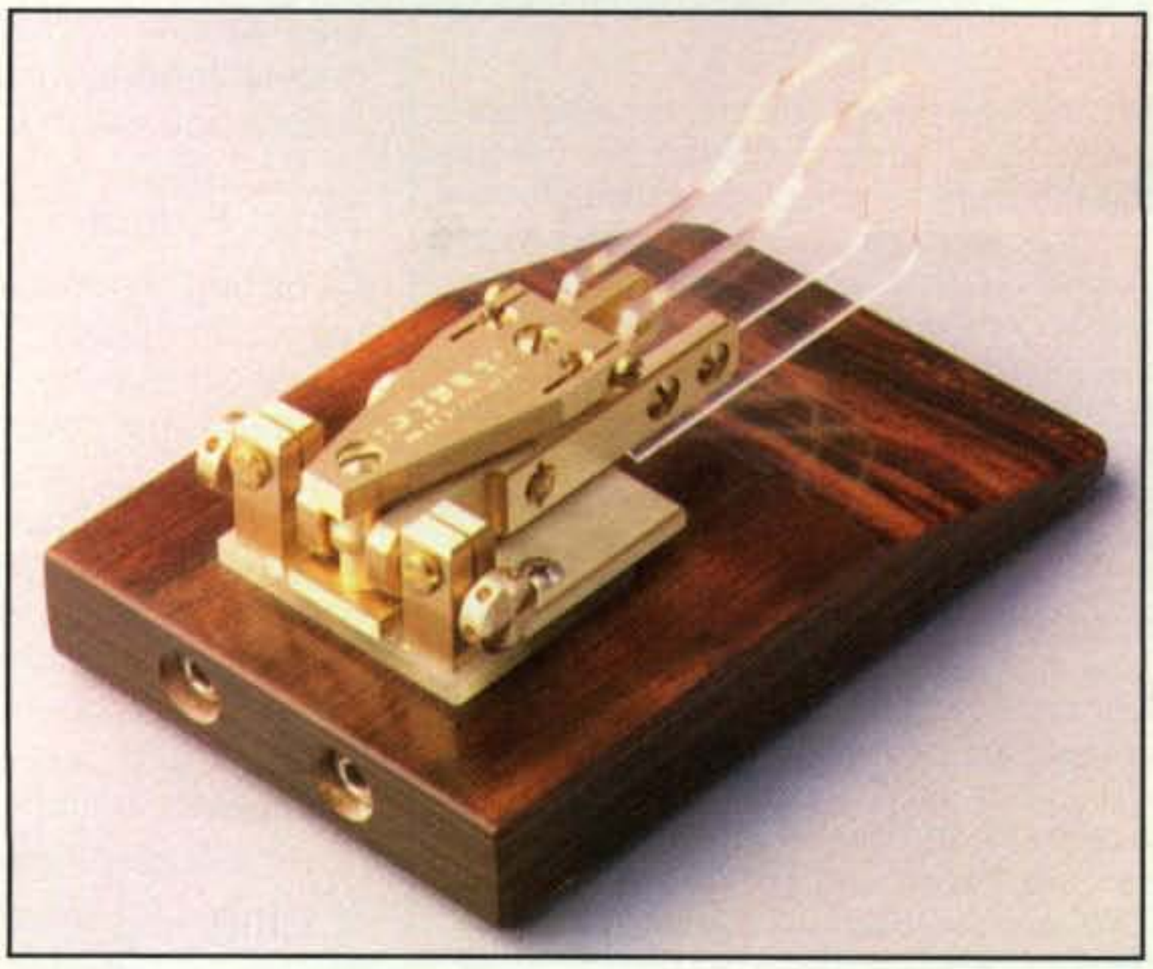

Photo D– One of the jacks on the back of the base connects the paddles to the radio. The second may be used for connecting a straight key. (See text for details.)

Next I positioned a small piece of printed circuit board on the back wall of the cavity to hold the connectors, and used some hot-melt glue to temporarily tack in place a tapered piece of wood to keep the lead out of the area needed for wiring (see photo B).

A box of 50-caliber musket balls provided the lead, but melting and pouring it presented a problem. For a crucible I used an approximately 3-inch section of 1.5-inch diameter black iron pipe with a screw-on cap. I poured the musket balls into the pipe, set it on a fireproof pad, and heated it with a propane torch. The lead melted quickly. Of course, I wore safety glasses, long pants, and heavy shoes just in case of a spill (see the sidebar on Lead Safety before working with lead).

Pouring the lead was the riskiest part of this project, as I was not sure what the high temperatures would do to the densified wood. To pour the lead, I grasped the heated pipe with a pair of channel-lock pliers. I immediately ran into two problems: First, a bubble formed in the cavity as I poured and moved to the top as the lead solidified. Second, I failed to remove the slag before pouring the lead. As a result, the surface of the lead was rough and ugly (see photo C).

Before I poured the lead into the second base, I was careful to remove the slag from the pot. It floats on top of the molten metal and can carefully be removed before pouring. The resulting improvement in the surface of the cast lead can be seen in photo B. Unfortunately, this time I heard a loud crack when the molten lead hit the base. The moisture in the wood vaporized when it was heated by the lead. The expanding water vapor caused the material to delaminate. I learned that this is a common problem with mass soldering of circuit boards and can easily be solved by slowly baking out the water in the oven. If I were to try this again, I would bake

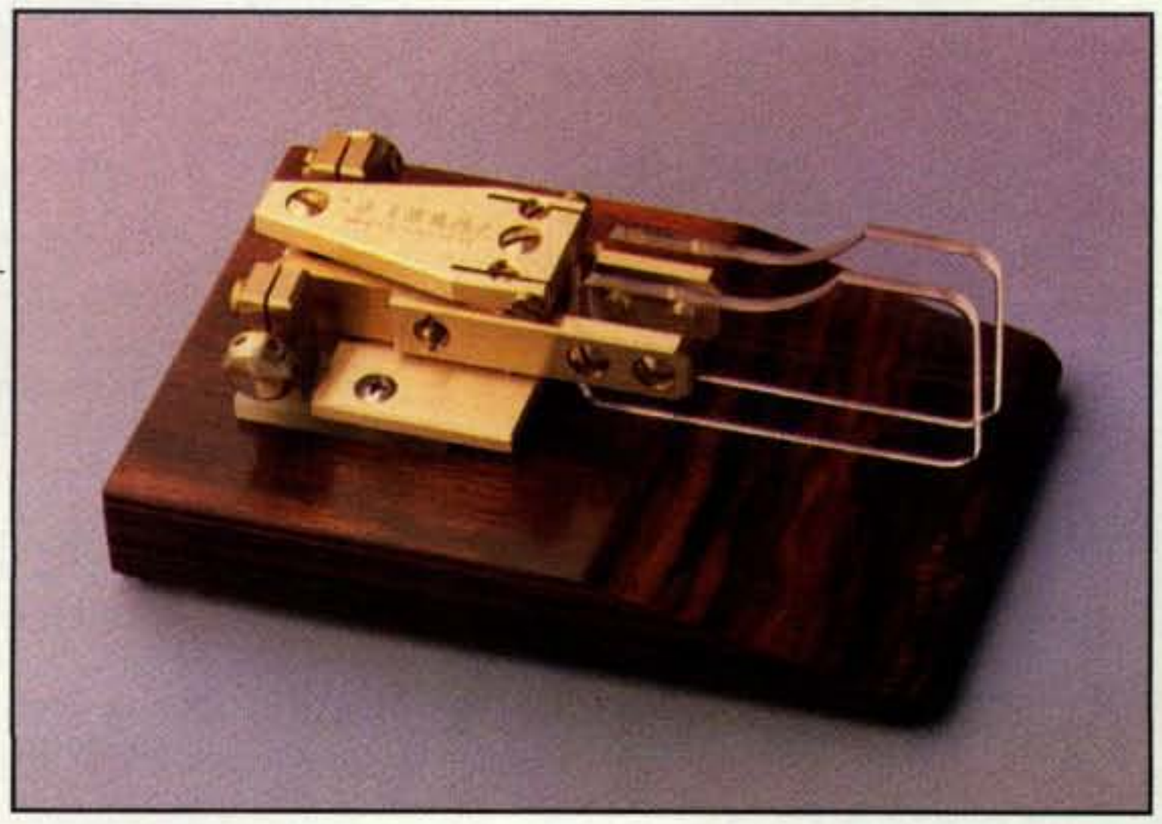

Photo E– The finished product—the Schurr Einbau Wabbler paddles mounted on a base made of densified wood and filled with lead for added stability.

Lead Safety

Nearly all electronic devices are assembled using lead-based solders, but lead causes serious health problems if the human body absorbs it. Safety concerns have prompted efforts to restrict the use of lead in electronics, but since acceptable substitutes are difficult to find, lead probably will continue to be used in electronics for the foreseeable future. Still, it is prudent to exercise reasonable caution when working with lead.

Lead in a radio does not pose a health concern if it stays in the radio. The same is true of lead-based paint in an older house. Remodelers who must disturb lead-based paint will try to minimize the dust created. To do this, they may choose to scrape off the paint rather than use a sander. This is because lead in a paint chip is less likely to be absorbed into the body than the small dust particles created by sanding. Responsible remodelers use elaborate dust-collection systems and personal protective equipment.

The best way to avoid creating dangerous lead dust is by casting the lead into its final shape. For the same reason it is also much better to slightly underfill the cavity with lead than to overfill and need to remove excess material. If lead must be cut, use a tool that makes a large chip. Try to avoid sanding if at all possible. When work is complete, thoroughly clean the work area and dispose of any lead-contaminated materials in compliance with your local laws and regulations.

More information on lead safety can be found at the Environmental Protection Agency's "National Lead Information Center" web page at <http://www.epa.gov/lead/nlic.htm>.

the bases in the kitchen oven on a fairly low temperature for several hours just before pouring in the lead.

Final Finish

Densified wood can be polished to a high-luster finish. To keep all the faces flat and the edges sharp, I did all the sanding and polishing by hand on an improvised surface plate consisting of a thick sheet of glass with wet and dry sandpaper placed on top. A small amount of water placed on the glass causes the paper to stick to it. I used progressively finer paper until I got to 600 grit, and then I switched to buffing compound to finish the job.

Wiring

The Einbau Wabbler comes equipped with rings to attach wires above the base. I discarded these rings and attached wires to the screws on the bottom which hold the terminals in place. I also drilled holes in the base just under these screws so that the wires could be invisibly routed to the cavity in the base. The screws that hold the paddle to the base make electrical contact with both the paddle and the lead mass. The connector's ground is attached to the lead with a short wire and a screw.

On an Elecraft K2, when both the left and right paddle lines are closed simultaneously, the radio interprets this as a hand-key input. A simple diode circuit described in the K2 manual makes it possible to have both a straight key and a paddle connected at the same time. I decided to include this circuit in the base of my paddle. That's the reason for the two 1/8-inch stereo jacks in the back of the base (see photo D). The paddle is connected to the radio through one of the jacks, and a straight key may be attached to the second jack. If you'll be using this with a rig that doesn't have its own keyer built in, it should also be possible to put a complete miniature electronic keyer in the base as well.

Results and Possibilities

Densified wood should work well as a base for nearly any key or paddle. For a hand key, it may even be heavy enough without adding the lead.

I have been very happy with my paddles and base (see photo E). Some expert operators who used this setup at Field Day were also favorably impressed. I am a long way from being a good CW operator, but my K2 and Schurr paddle encourage me to keep improving my skills. ■

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Non-RF Wireless Transmission of Audio

BY IRWIN MATH,* WA2NDM

In the February column we introduced you to several non-RF wireless transmission systems from the early days of radio. This month we would like to expand on one of them, giving a couple of practical applications for around the house or shack. The method I am about to describe uses inductive coupling to transmit audio for a short distance without electromagnetic (RF) waves of any kind.

Fig. 1 shows the basic principle, which most of you should recognize as nothing more than a spread-out common transformer. An audio signal is applied to one winding, and by means of magnetic induction it induces an audio modulated current in the other. If the various components are chosen and built with care, the results can be quite useful, and there is no RF interference to deal with.

The first approach will require an audio amplifier with as much output power as you can find. A common 100+ watt PA (power amplifier) unit would be perfect. However, lower power units may also work well. For the transmitting loop you must first circle the area in which you wish to transmit (and contain) the signal. If the area is an entire room in the house, you can run some #26 to #30 enameled wire around the perimeter of the room on top of the baseboards and up and over the door moldings. If you do the job carefully, the wire will virtually be invisible. Next measure the resistance of the loop with a DVM (digital voltmeter). If you are lucky, the resistance will be close to some standard audio impedance value such as 4, 8, or 16 ohms. If it is less than 4 ohms, for protection you must add series resistance until it is at least equal to the lowest impedance output tap of the amplifier. Be sure to use a 5- or 10-watt power resistor to prevent overheating. Now connect both ends of the loop to the output terminals of the amplifier and the transmitter is completed.

The receiver is shown in fig. 2. It consists of a pickup coil and a small 9-volt battery powered audio amplifier. Tiny audio currents picked up by the coil are amplified by the LM386 to a level suitable to drive a pair of low-impedance headphones. It should be noted that the amplification of this stage is on the order of 200, so be sure to always start with the GAIN control at minimum to protect your ears. The construction of the pickup coil will depend on the housing you plan to use for the amplifier. If you choose one of the inexpensive 2" × 3" or 2" × 4" "plastic hobby boxes," 300 to 400 turns of #30 (or smaller) enameled wire wound around the long perimeter of the enclosure will be fine. Otherwise, wind a similar coil around a 2" × 3" or 2" × 4" non-metallic form for the pickup coil. Secure the wire to the box (or form) with varnish, polyurethane, etc.

*c/o CQ magazine

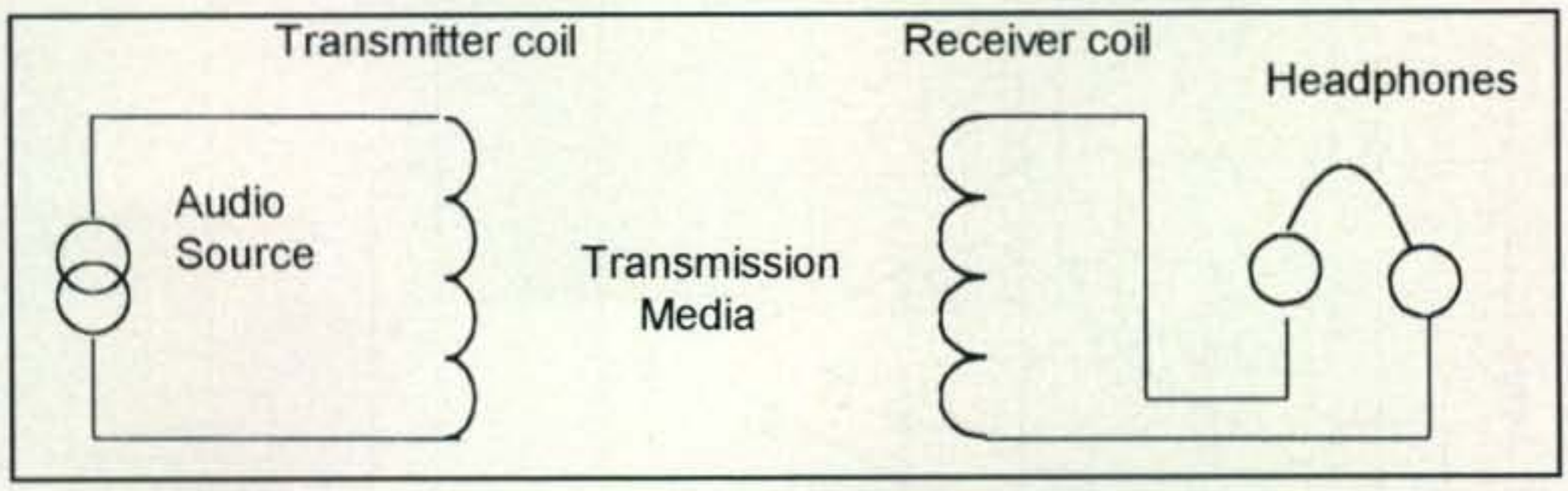

Fig. 1 – Basic inductive transmission system.

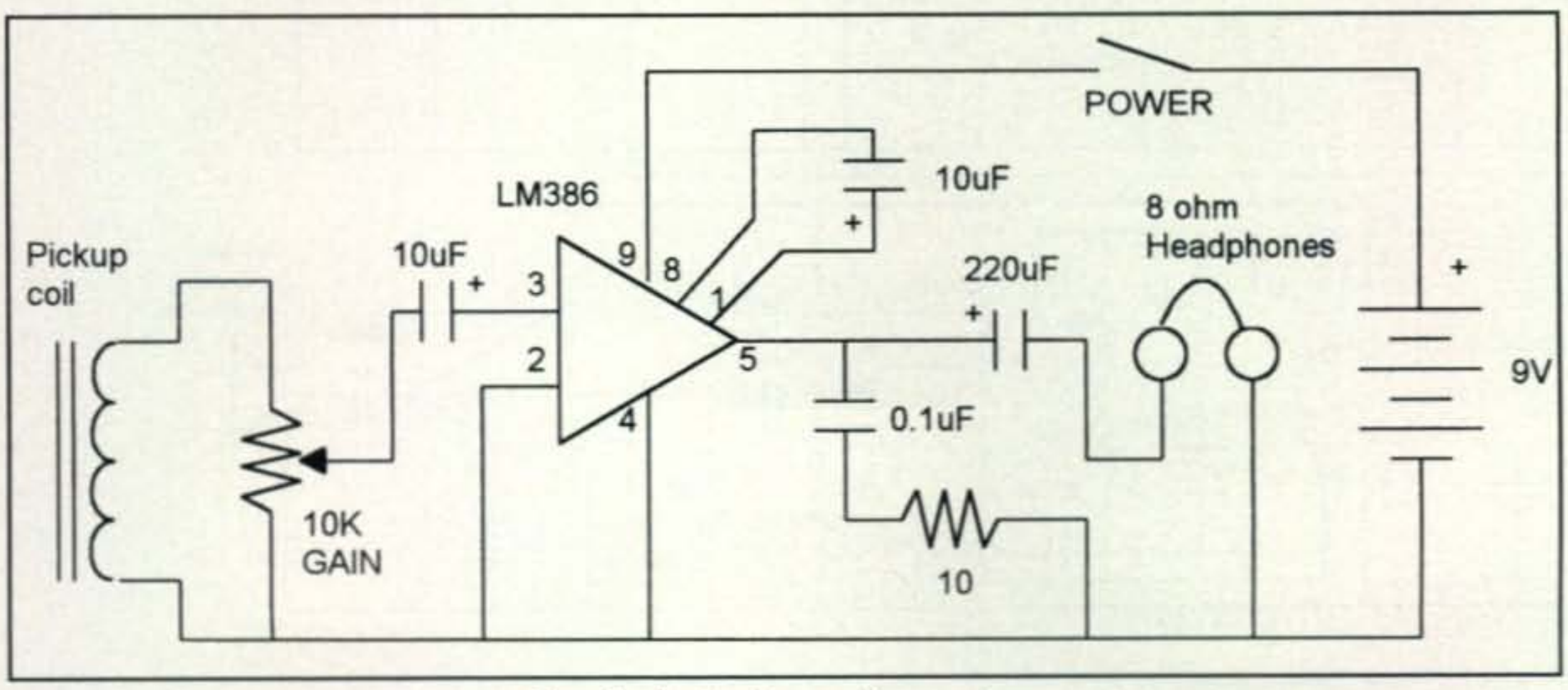

Fig. 2 – Inductive audio receiver.

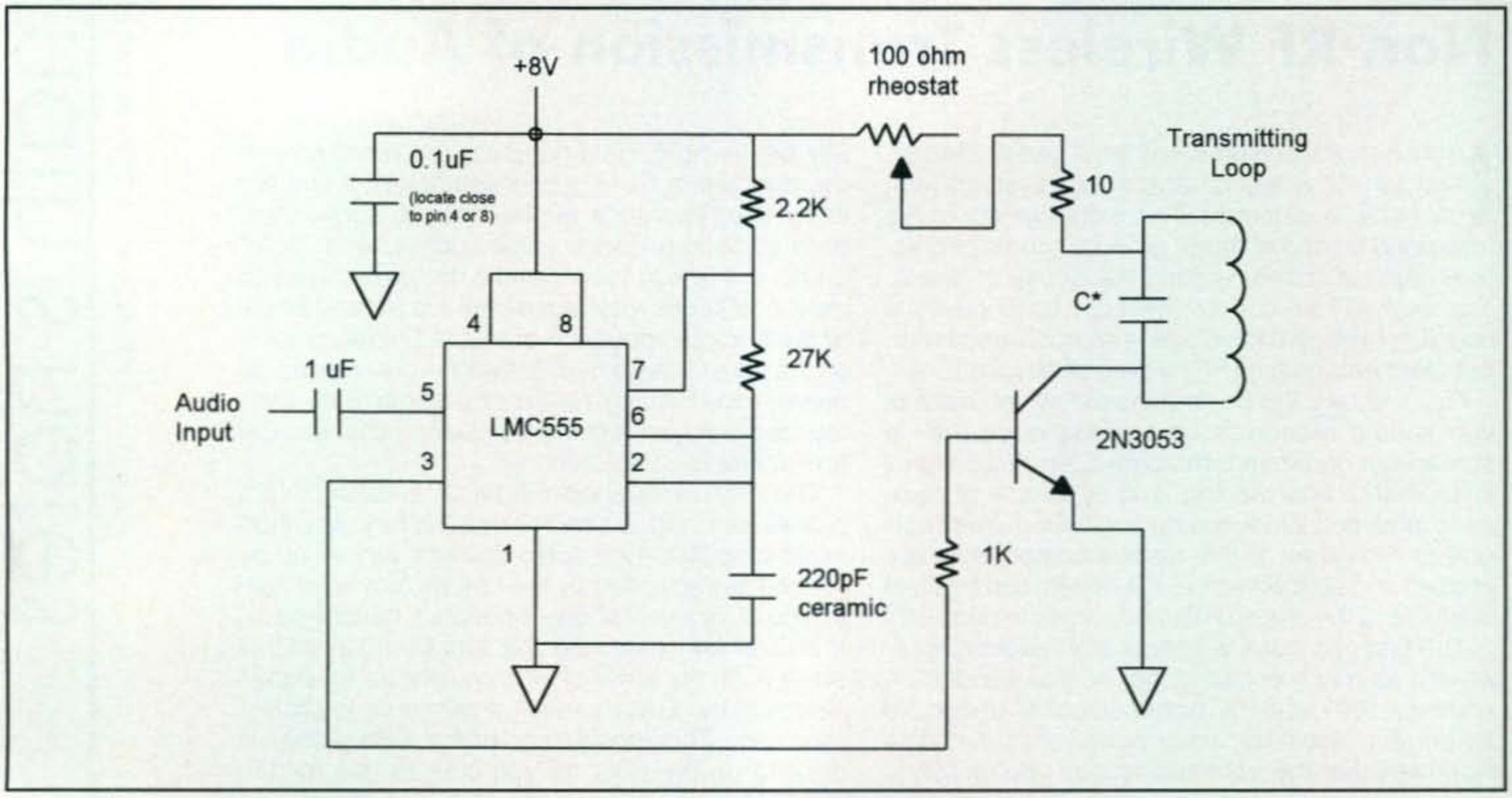

Fig. 3 – The 75-kHz FM inductive transmitter.

To test the system you must first connect a source of audio to the input of the power amplifier. This can be anything from a CD player, the output of a small radio, or even the audio from your station receiver. Place the receiver a couple of inches from the transmitting wire and adjust the gain of the receiver as well as the gain (volume) of the amplifier until the received audio is clear. When adjusting both gain controls, try to use as little gain from the power amplifier as possible. Next move the receiver to the middle of the area circled by the loop. You should be able

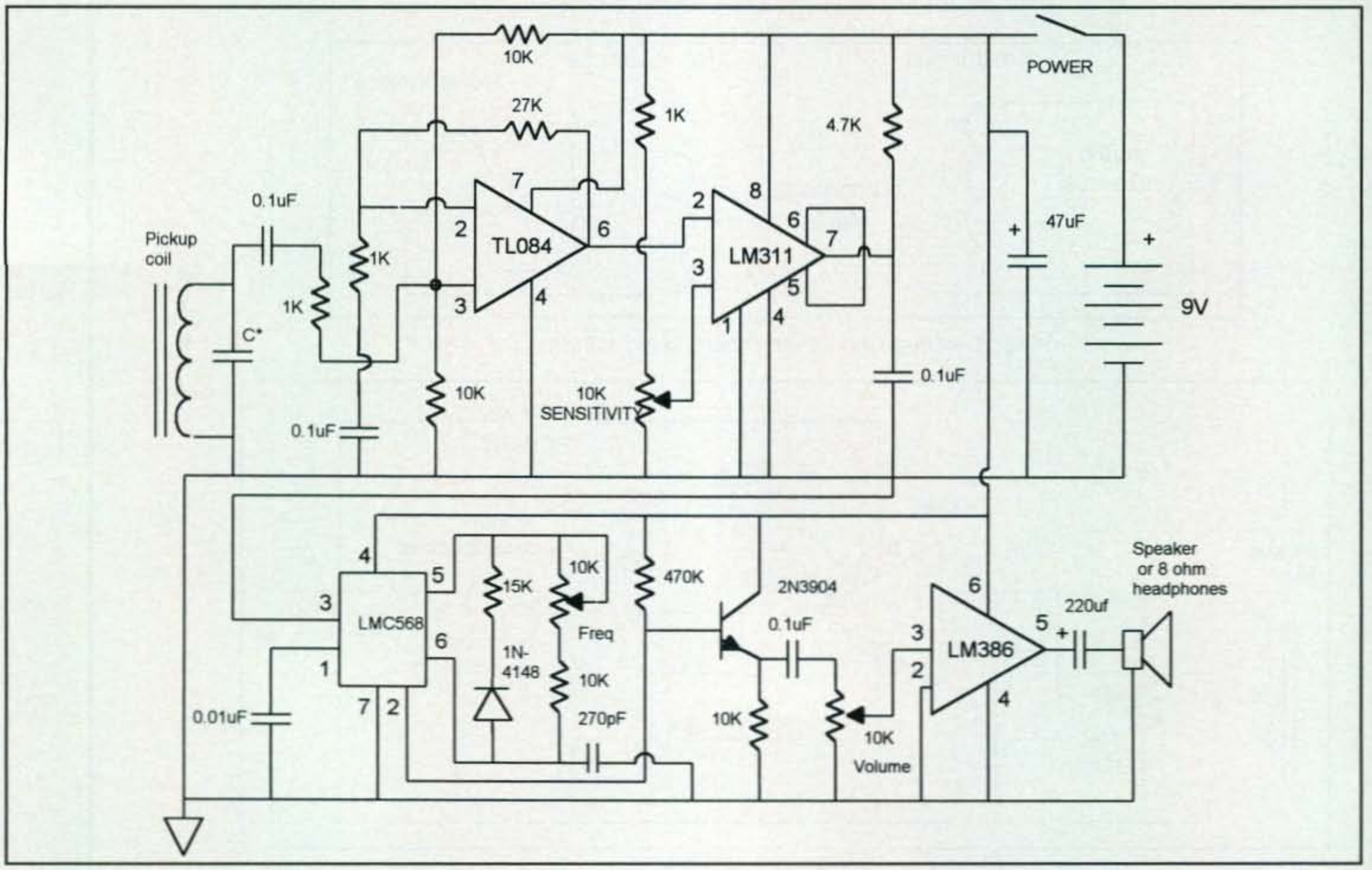

Fig. 4 – Inductive FM receiver.

to pick up audio anywhere within the loop, as well as a short distance outside of the loop. If the signal drops off too much, raise one or both gain controls. Now replace the source of audio with the one you wish and readjust the gain controls for best results.

The system described above uses simple AM for transmission, and as a result will vary in volume at various points within the transmitting loop. Fig. 3 shows a way to FM modulate a 75-kHz (approximately) carrier with audio and apply it to the loop to eliminate any variation in volume. In this circuit an LMC555 acts as a modulator and produces a square wave that varies in frequency as a function of the incoming audio. The peak-to-peak output of the LMC555 is constant. This signal is then applied to a power transistor that produces 75-kHz current pulses through the transmitting loop. The rheostat and 10-ohm resistor in series with the loop are used to limit the current to a level that the power transistor can handle. When building this transmitter be sure to set the rheostat to maximum resistance (100 ohms) before starting, and then carefully adjust it so that the transistor does not overheat.

The 2N3053 can be replaced with almost any similar NPN power transistor and can even be heat sunk if desired. The capacitor labeled C* across the loop is an option that may enable you to actually tune the loop, thereby increasing the strength of the pulses. Its value will depend on the final inductance of the loop. To determine the correct value, connect a scope across the loop, a capacitor decade box in place of C*, and adjust for maximum voltage as measured on a scope. Then replace C* with the nearest value that you have on hand. This is an option, however, and is suggested only if you wish to experiment.

The receiver for the FM transmitter is shown in fig. 4. The receiving coil is fabricated in the same way as in fig. 2 but with only 100 turns due to the higher frequency. The capacitor across the receiving coil is used to tune the coil to 75 kHz and is selected by the same method as discussed previously. If you do not wish to attempt this, leave it out. You probably will still be fine.

The coil is connected to an op-amp amplifier stage with a gain of approximately 30. This stage raises the received signal and applies it to an LM331 comparator. This stage acts as a limiter, removing any variation in received signal level. The 10K potentiometer in this stage is used as a sensitivity control and sets the point where the comparator triggers. The limited signal is then applied to an LM568 FM detector stage, where the audio is recovered. The 10K pot in this stage is set to the expected center frequency of the received FM signal. This is done by measuring the frequency of the transmitted FM signal with a frequency counter and then setting the pot so that the free-running frequency, measured at pin 5 with the same counter, is twice as high (or roughly 150 kHz). The final stage is an LM368, which is used to drive the speaker or headphones.

When adjusted properly, this version will allow constant audio volume anywhere within the transmitting loop. Of course you can experiment to your heart's content with the system and perhaps even achieve a fairly significant transmission range beyond the loop. If the power amplifier you originally used is capable, you might even try driving it with the output of the FM modulator and connecting it to the loop for still more range. Either way you will have a general idea of how an FM system works.

We plan to use much of the above circuitry later this year in this column when we describe a second-generation optical transmission system for experiments in the THz region, so most of your effort will be used again shortly.

Good luck, and most of all have fun with the above.

73, Irwin, WA2NDM

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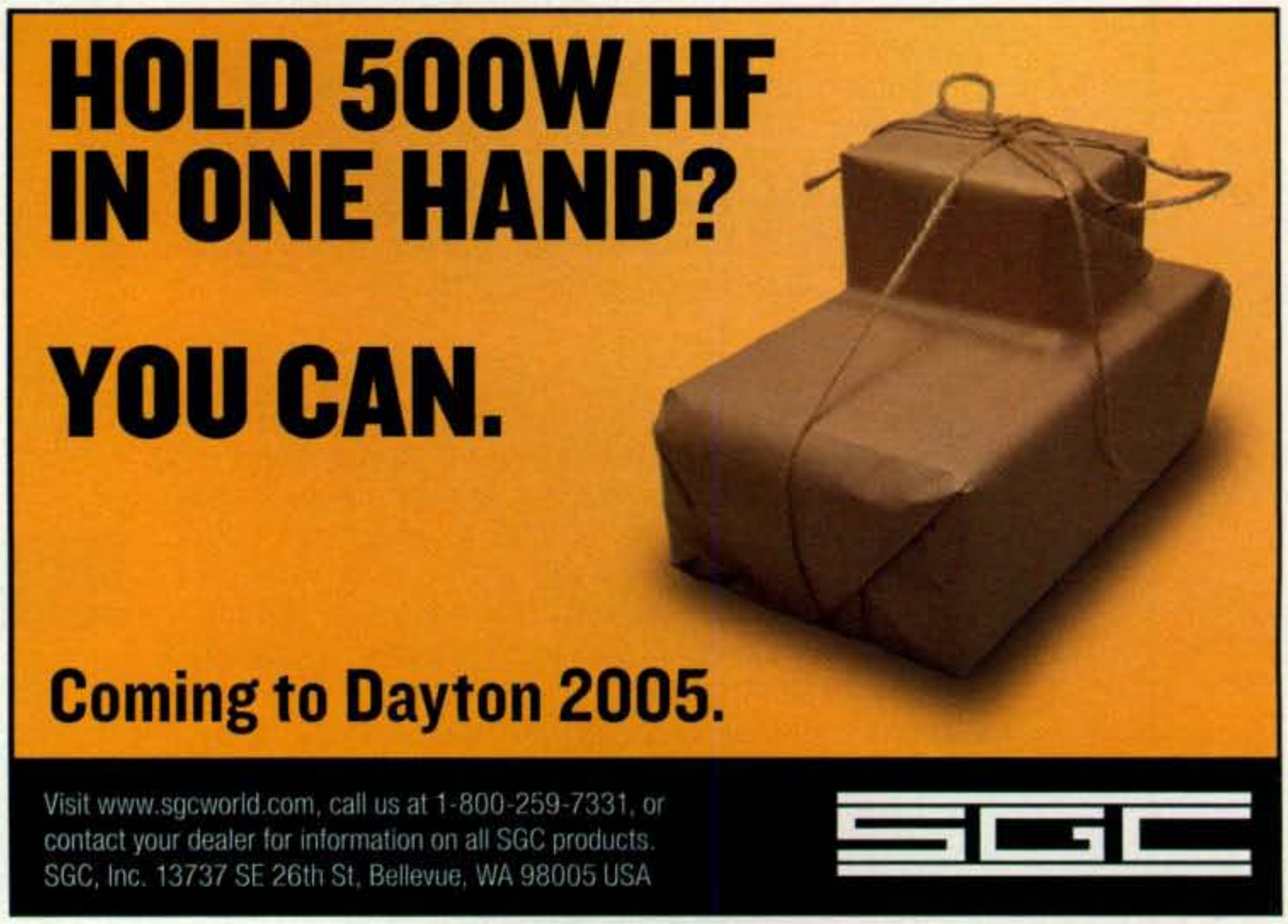

Covert Classics: A Spy Radio Special

BY DAVE INGRAM,* K4TWJ

Spy radios and special-purpose military radios, especially those from the World War II era, are items of high interest among many amateurs, both nationwide and worldwide. Indeed, a surprising number of folks enjoy collecting, restoring, and occasionally using these mini rigs on the air today just for fun. Finding these units in like-new condition is a major challenge, so some enthusiastic amateurs have home-assembled replica units that are exact to the finest detail—and they work great to boot. What is so captivating about these oversize and under-feature spy rigs? You certainly can do more with a smaller "do it all" SSB/CW transceiver such as Yaesu's FT-817 or ICOM's IC-703, but the sheer fun and fascination of using a genuine spy radio is beyond compare. It might be compared to fixing up and driving a vintage automobile—no big fuel-injected engine, no power brakes or steering, no airbags or air conditioning, but the thrill is in a class all its own. Personally, I can't resist the soft glowing warmth and real radio atmosphere of vacuum-tube gear—any kind, any size. It's terrific!

Vintage spy radios typically consist of a simple receiver, crystal-controlled 5- or 10-watt transmitter, common high-voltage power supply, and wide-range antenna matching network. They were used by true 007-type secret agents in everything from quaint country cottages to dim hotel rooms behind enemy lines. Frequently external encryption devices were also employed with the rigs. The combination allowed an undercover agent to prepare a secret message, and then transmit it quickly and discreetly to avoid detection by "spy sniffers." This cat-and-mouse game was rather elaborate for its time.

Security officers monitored both the AM band and shortwaves not only for CW messages from nearby transmitters, but also for weak carriers produced by the oscillating detector in regenerative receivers. Realizing that fact, some spy radios included an extra RF amplifier stage to help isolate their telltale oscillator stage from the antenna. Intriguing, isn't it? That's enough background information. Now let's look at some genuine spy radios compliments of our special guests, Des O'Brien, ZL2OB, and "Flying" Jack Camp, WA4AGS.

The Paraset

A captivating little British spy set made for the resistance forces during World War II (and highlighted in *RadCom* magazine 20 years ago) was a small three-tube/5-watt transmitter-receiver unit called the Paraset. It employed a 6V6 crystal-oscillator-type transmitter, a 6SK7 regenerative detector, and 6SK7 AF amplifier-type receiver. It operated from a multi-battery or 6-volt vibrator-type supply, and its tunable receiver covered approximately 3 to 8 MHz. The Paraset was produced in metal-case, suitcase, and wood-box versions, and almost all of them disappeared over time. Mario Glasso, IKØMOZ, has devoted substantial effort to resurrecting the little gem, however, and reproduction details have been appearing on the web at <www.qsl.net/ik0moz>.

After studying Mario's details and drawings, and with having had the experience of home-producing several outstanding Morse keys (we present-

Photo A– An exact replica Paraset World War II spy radio built from scratch in 2004 by Des O'Brien, ZL2OB. The unit is a 5-watt trans-receiver covering 3 to 8 MHz. The tube lineup (from top left) is two 6SK7s and a 6V6. Controls (from lower left) are bandspread, main tuning (with skirt), regeneration, antenna loading, plate tune, and bandswitch. The frequency chart, tubes, and crystal store in the lid. (Photo courtesy ZL2OB)

Photo B– Inside view of ZL2OB's Paraset replica reveals authentic "rats nest" construction. The three variable capacitors are transmitter plate tuning, antenna loading, and receiver tuning. Only main winding of the transformer (lower right) is used (plate load for audio stage). (Photo courtesy ZL2OB)

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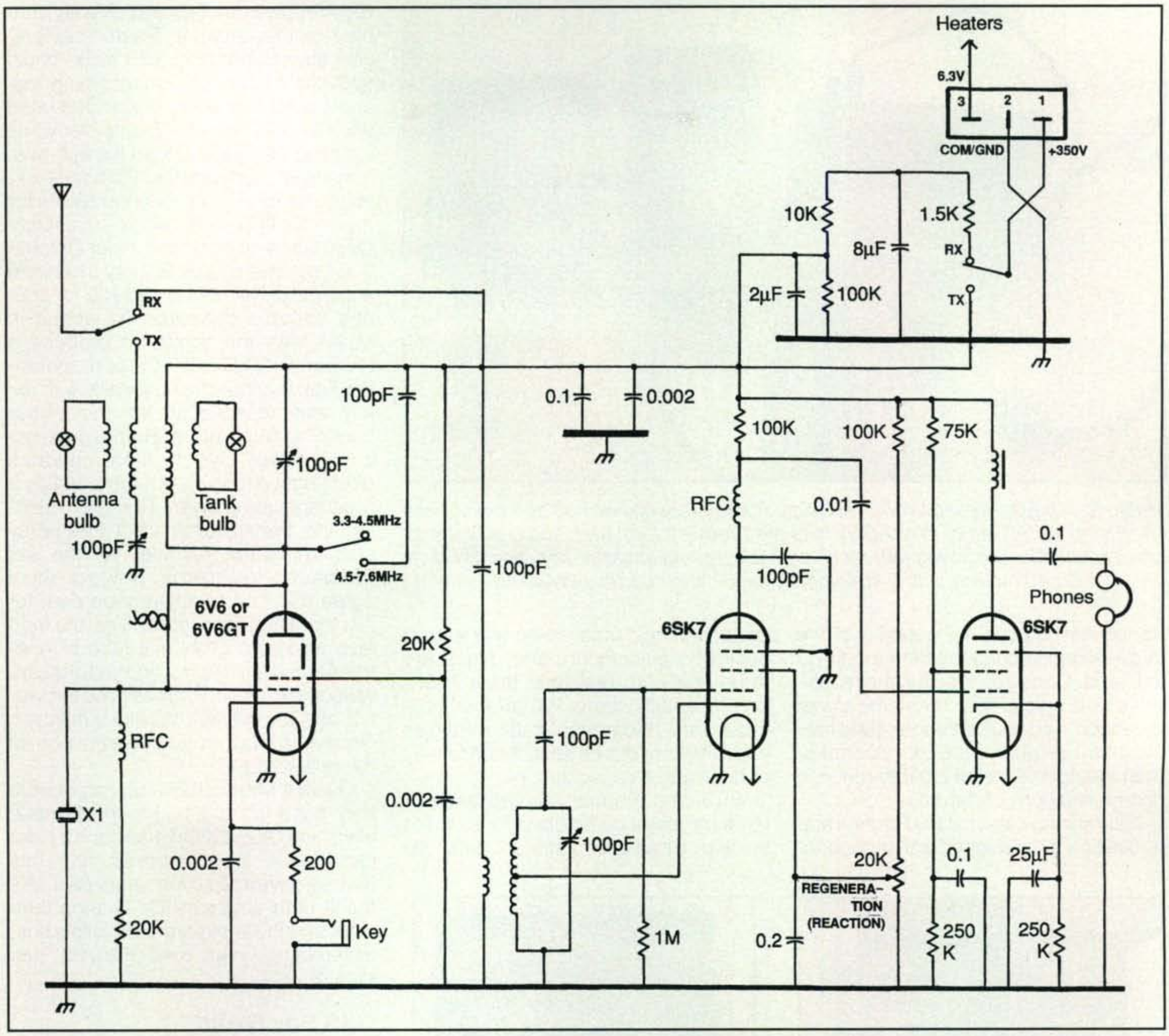

Fig. 1– Circuit diagram of the classic World War II Paraset spy radio. (Discussion in text.)

ed them in a previous "Keys" column), Des O'Brien, ZL2OB, recently built his own replica Paraset (photos A and B). Des passed along a photo of an original Paraset, and although too low in quality to print here in the column, it reveals his modern reproduction is absolutely identical to the original. Des says it worked fine right from the start. It will load almost any length of wire, and he even reground a couple of old 6-MHz crystals to use with the Paraset on 40 meters. Awesome!

In looking at the Paraset's circuit diagram (fig. 1), we see the transmitter is quite similar to the classic little 6L6 transmitter featured in our October 2004 "World of Ideas" column. The only significant difference is that small (NE-2-type) neon lamps in the plate and antenna circuits are utilized as tuning aids, and a "gimmick" capacitor made by twisting two insulated wires together neutralizes grid-to-plate capacity. You may also recognize the receiver's circuit as a famous "two stepper" from the 1930s; it also used a 6SK7 detector with its output capacitively coupled to another 6SK7 serving as an audio amplifier. The Paraset's bandswitch only affects the

The Paraset

Transmitter

Plate coil: 18 turns No. 16 insulated wire on 1.5-inch diameter form

Antenna coil: 22 turns No. 18 insulated wire spaced .3 inch from plate coil

Pickup coil: 1 turn No. 18 insulated wire placed inside coil form

Receiver

Antenna coil: 4 turns No. 24 enamel-coated wire on 1.25-inch form

Grid coil: 35 turns No. 24 enamel-coated wire spaced .1 inch from antenna coil

Fig. 2– Coil details for the transmitter and receiver in the Paraset. (More details in text.)

Photo C– Original World War II OSS Spy Radio presently owned and maintained by "Flying" Jack Camp, WA4AGS.Units are (from left top): switchbox, power supply, transmitter, and (lower left) receiver. Jack says he occasionally uses this radio on 40 meters, and it still works well. (Photo courtesy WA4AGS)

transmitter, so one full rotation of the large skirted knob tunes from roughly 3 to 8 MHz. Consider, too, that the receiver lacks a crystal filter for single signal reception, and you can understand how this little treat proves the operator rather than the rig makes the big difference in communications capabilities.

Look slightly closer at the Paraset and notice how it is designed with redundant parts for in-field repairs with only a small pack of replacement parts. There are three 20K-ohm resistors, three 100K-ohm resistors, three 100-pFd variable capacitors, and a regular .01-mFd disk capacitor that can be substituted for any of the bypass capacitors, etc.

While the Paraset served well for medium-range communications during the war, it had one significant pitfall: Its regenerative detector was directly coupled to the antenna. Sharp "sniffers" with direction-finding (DF) loops could spot it in a flash. This shortcoming was addressed in a later version that used another 6SK7 as an RF amplifier while isolating the detector from the antenna.

Further studying the Paraset's circuitry, we see it is an ideal candidate for my "K4TWJ Wireless Injection Oscillator Mod" included in our October 2004 column on the 6L6 rig. That is, a small 12-µHy inductor and 100- or 360-pFd variable capacitor are added in series with the crystal to produce a (transmit) VXO. A 50K-ohm potentiometer is connected in parallel with the key and adjusted so the transmitter "leaks" a .5- or 1.0-milliwatt signal into the receiver, which then operates direct-conversion style rather than as a regenerative receiver. Then, too, shifting the transmitter's VXO frequency also shifts the receiver so the set becomes a transceiver. Now you must agree that is a romping good deal for just three additional parts! Yes, the mod also works on other one-tube or one-transistor transmitters, and yes, you are welcome to use it. I only ask you to credit it as "The K4TWJ Wireless Injection Oscillator Mod" in your description of the related rig.

Overall, Mario, IKØMOZ, has done a very good job of keeping the Paraset alive, and Des, ZL2OB, has done a most remarkable job of reproducing this famous covert radio from eras past. We thank both amateurs for sharing their work and invite everyone to follow suit, assembling your own Paraset just for fun!

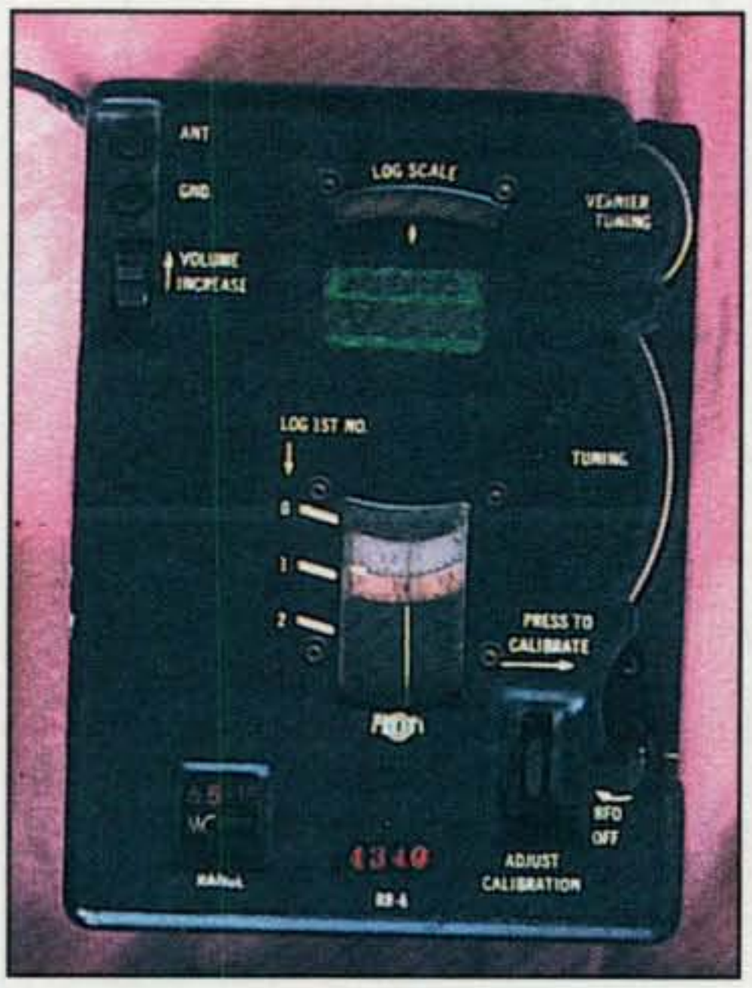

Photo D– Close-up view of the OSS receiver shows recessed knobs (on right side) and a precisely calibrated dial (in the middle). The little unit is especially designed for impromptu operation from a variety of locations. (Photo via WA4AGS)

Photo E– Close-up view of the OSS transmitter shows more recessed knobs, evidently for holding adjustments while being transported in a large coat pocket or travel bag. Just plug in a crystal, tune the rig, and it's ready for action. (Photo courtesy WA4AGS)

OSS Spy Radio

Views of our next spy rig—a four-piece setup like that used by American OSS agents during World War II and presently owned by "Flying" Jack Camp, WA4AGS—are shown in photos C, D, E, and F. This modular setup consists of a six-tube receiver, two-tube transmitter, AC power supply, and interconnecting switchbox. Each unit is quite small, but short cable lengths require them to be positioned in a set order for use.

The receiver covers 3 to 22 MHz and features a superheterodyne circuit design using miniature "Bantam" tubes, which was quite clever for its time. Bantam tubes were used in early-model hearing aids. They are approximately 2 inches tall and 1/4 inch in diameter (the same size as a wood pencil). They often have a narrow glass base with protruding pins and are direct-soldered in a circuit. They were rather scarce during the

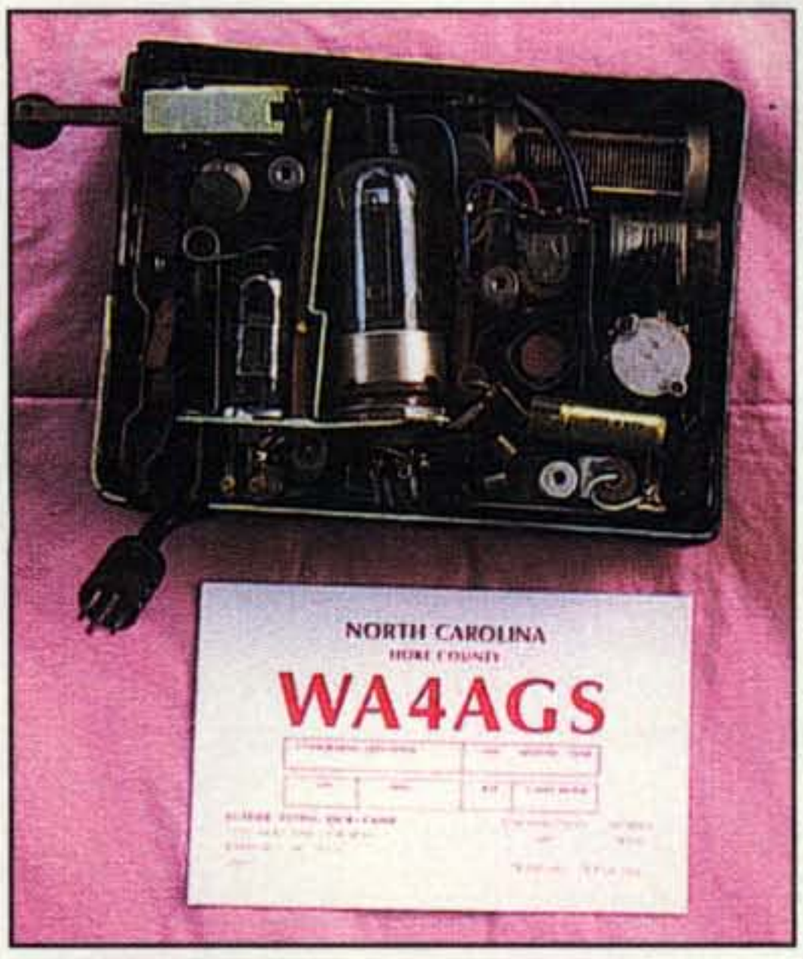

Photo F– Inside view of the OSS transmitter shows 6AG5 and 2E26 tubes squeezed into tiny shielded compartments. It is a packed case and a hot little rig for sure! (Photo via WA4AGS)

"good old days," are even scarcer today, and are real attention grabbers (do any readers remember Bantam tubes or know of a present-day source?). Look carefully at all the controls on all the units in this setup and you will note they are recessed for hearty "grab and go" operation.

The transmitter is also impressive for a 1940s unit. It sports a 6AG5 driving a 2E26 that produces 10 to 15 watts output. Two small neon lamps and a No. 47 pilot lamp are used in lieu of meters for tuning. The 2E26 was a sort of smaller and low-power version of the 6146. It was a technological newcomer in the 1940s, and it quickly gained widespread popularity—especially in VHF gear.

As Jack, WA4AGS, tells us, some models of this spy radio were supplied with a code-burst device that could encrypt a message, speed it up, and transmit it on command as a brief burst of code. A receiving station would copy the message by tape and then slow it down and decipher it. That seems quite logical, as an ultra-compact transmitter with a 2E26 and no cooling fan would probably double as a hotplate or toaster if left on very long. That also explains why the mating receiver has two logging scales and an easily accessible calibrator. It was probably "fired up" and used quickly and while cold, and its injection oscillator was not crystal controlled, so it probably drifted rather noticeably. Jack says he has used the setup on 40 meters a number of times, even while aeronautical mobile, and he has made some memorable contacts with it. The little spy radio is obviously a collector's pride, possibly the forerunner of modern "manpacks" and mini rigs, and we thank Jack for sharing details of it with us.

Conclusion

In wrapping up this month's column, I think about various other special-purpose military rigs produced over the years and invite (encourage!) present owners to share some views of their rigs via this column. Just send me a couple of good 35-mm photos or digital images between 250k and 1 meg plus a copy of the rig's circuit diagram, and I will write up the details and get plenty of compliments headed your way. I especially remember a small transistorized transceiver in a sort of lunchbox case that was used by Special Forces in Viet Nam (PRC63 or PRC65?). Do any readers own such a unit?

Until next time, regardless of your rig, keep hamming it up!

73, Dave, K4TWJ

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On the Cover

"This is a relaxing departure from what I work on every day," says Ralph Bartlett, W4ZO, of Indian Trail, North Carolina, referring to his collection of vintage radio equipment and his affinity for operating AM. Ralph is a service engineer for Motorola and says he spends his days working on state-of-the art digital radios, and then relaxes by restoring and operating classic analog AM gear, with plate modulation and Hi-Fi audio.

Ralph says he's been collecting vintage radios for just over a decade and has amassed some 35 to 40 pieces of old ham gear—90% of which he's restored to operating condition—plus several old home broadcast receivers and even two AM broadcast transmitters (he's planning to convert one for use on 160 meters!).

Like many hams who collect classic radios, Ralph says he started out trying to replicate a station from his past. In his case, it was some of the equipment that belonged to his mentors when he was just starting out. For example, he says, "One guy I knew as a teenager had an NC-83 receiver, a Johnson Valiant transmitter, and some Collins S-line gear as well. His efforts to reassemble that station got him started."

Ralph's current project, he says, is to work out the audio chain of a BC-610 transmitter (made by Hallicrafters for the military during World War II), and to eventually put that radio on the air along with a Hallicrafters SX-28 receiver.

Ralph's interest in the 1940s and '50s goes beyond his radios. The black-and-white checkerboard floor in his combined workshop/ham shack is classic postwar design, as are the chrome lamps he also has scattered around (although none are visible in the photo). You can catch W4ZO on AM on 40, 160, and 80 meters, as well as the VHF bands, where he works both AM and SSB. *(Cover photo by Larry Mulvehill, WB2ZPI)*

Reader Survey March 2005

We'd like to know more about you—about who you are, where you live, what kind(s) of work you do, and of course, what kinds of amateur radio activities you enjoy. Why? To help us serve you better.

Each time we run one of these surveys, we'll ask a few different questions and ask you to indicate your answers by circling numbers on the Survey Card and returning it to us. As a bit of an incentive, we'll pick one respondent each month and give that person a complimentary one-year subscription (or subscription extension) to *CQ*.

This month we'd like to get a sense of how involved you are with building stuff for your ham station.

Please answer by circling the appropriate numbers on the reply card.

1.Do you consider yourself to be a builder/homebrewer?
Yes 1
No 2

2. What sorts of stuff (if anything) have you built? (Circle all that apply)
Transceiver 3
Transmitter 4
Receiver 5
Antenna 6
Station accessory 7
Station furniture 8
Computer 9
Computer network 10
Other 11
Nothing 12

3. When did you build your first ham project?
Within the past year 13
Within the past 5 years 14
Five to 10 years ago 15
Ten to 20 years ago 16
More than 20 years ago 17
Never 18

4. How long ago did you build your most recent ham project?
Within the past year 19
Within the past 5 years 20
Five to 10 years ago 21
Ten to 20 years ago 22
More than 20 years ago 23
Never 24

5. Where did you get the designs for your projects? (Circle all that apply)
Design posted on web 25
Design published in magazine 26
Design published in book 27
Kit instructions 28
Self-designed 29
Other 30
None 31

Thank you very much for your replies. We'll be back with more questions next month. (PS: Responses to our January survey will be published next month.)

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BY JOE VERAS,* K9OCO

An Ocean Hopper Experience

In recent months I have been watching my dad disappear into the impenetrable fog of Alzheimer's disease. Among those things being lost are nearly five decades of our shared experiences in amateur radio. The present is an uneven mix of good and bad days, but occasionally something drifts in from out of the past to brighten even the worst of them.

In mid-November, I was scanning the morning's e-mail when a line from a ham in Ohio caught my eye. "I recently bought on eBay an old Knight-Kit Ocean Hopper that once belonged to you," it read. The e-mail was from Carl Denbow, N8VZ, in Athens, Ohio. My callsign (the same now as it was in 1957) was on the documentation included with his radio. He looked me up on QRZ.com, obtained my e-mail address, and sent me news of the long-lost Ocean Hopper. Carl asked for details on the radio's early history and wanted to know, in particular, about its nice wooden cabinet.

Carl and I continued our correspondence, and as I filled in the details about my radio, he explained the motivation for his own Ocean Hopper search. Common to nearly all vintage-radio enthusiasts, whether their collection is a single piece or numbers in the hundreds, is a desire to have a duplicate of one's first transmitter or receiver. So it was with Carl. He had obtained his original Ocean Hopper in about 1958 through a trade with Jim Eblin, K8DHW, a family friend who lived in Athens at the time. That Ocean Hopper was Carl's first shortwave receiver, and with it he took his first steps down the path so many of us have walked, although his journey to a ham ticket did not end until 1981. That common thread also runs through many amateur radio lives as we deal with education, career, family, and other responsibilities along the way.

Carl's amateur career has been an active one covering a wide variety of interests. He received his Novice license and the callsign KA8JXG in 1981. Two years later he upgraded to Technician, and then in April 2000 to General. The next two-year interval found him passing the Extra Class exam, and in May 2002 Carl became N8VZ. His on-air activities include working PSK31, HF and VHF packet, RTTY, and SSB. He can be found on 6 and 10 meters during band openings. He participates in the Ten-Ten International Net and the Christian Amateur Radio Federation and is active in his local club, the Athens County Amateur Radio Association. Carl enjoys QRP with the Elecraft K2 he built and now has an Ocean Hopper revival project to his credit.

The Model 749 was the last of the Knight-Kit Ocean Hopper line. The example pictured here dates from the mid-1960s and is from the collection of Dave Ishmael, WA6VVL. (Photo © Joe Veras, 2005, all rights reserved)

For most of us, the name Ocean Hopper calls to mind the Model 740 and 749 three-tube Knight-Kit receivers sold by Allied Radio in the 1950s and '60s. As early as 1939, Allied published the circuit for a two-tube "Ocean Hopper" in its *Radio-Builder's Handbook*. The company sold a kit of parts, complete with a drilled and punched metal chassis and panel, through its Knight division. The original OH design used 6J7 and 6C5 octal-base, metal tubes. Power for the set was furnished by A and B batteries or an AC supply constructed according to plans in the handbook. Subsequent editions of the handbook offered new versions of the Ocean Hopper, and the tube lineups were changed to permit AC/DC operation, eliminating the power-supply transformer and the necessity of a separate filament supply voltage. The last two-tube Hopper employed 12J5 and 117P7 tubes. Production of this version ceased in 1953, and it was succeeded by the Model 740.

A Mission

Early in the summer of 1957, while visiting my grandmother in Chicago, Dad and I made a trip to Allied Radio, then at 100 N. Western Avenue, west

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of the city's Loop. For a kid just getting his feet wet in the radio hobby, it was a died-and-gone-to-heaven experience. The ads on the pages of ham magazines suddenly had come to life. Along with its own line of Knight-Kit equipment, Allied's large store carried new and used gear from nearly every other manufacturer. I also remember seeing turntables, amplifiers, and speakers—what we called *hi-fi* gear back then. Allied was also an incredible parts house. If you wanted to build or repair something, it seemed to me that anything needed could be found on its shelves or in the warehouse.

All of these things—the expensive ham and hi-fi gear, all the tubes and parts—were just momentary distractions. I had come to Allied on a mission. In my pocket was about fifteen dollars in small bills and loose change. My heart was set on returning home with a Knight-Kit Ocean Hopper. I did not go away disappointed, but when it came time to make my purchase, I faced some tough choices. As I stacked my dollar bills on the sales counter, then counted out the change beside them, it was apparent my funds would come up short of the amount necessary for a full-blown Ocean Hopper outfit. I could afford either the cabinet or the optional coils, so I decided in favor of the coils—although I did not get the coil that covered 155 to 470 kHz.

I was eager to assemble the kit that evening, but common sense, and Grandma's lack of a good radio workbench, dictated waiting until we returned home from Chicago. Dad gave me a short tutorial in the use of the basic tools and techniques required and then turned me loose. He checked my work as things progressed, and when I reached the rudimentary manual's last page it was show time. The Ocean Hopper came to life as its tubes warmed up, and Dad ran me through the basics of adjusting and tuning a regenerative receiver. He seemed to get quite a kick out of the Ocean Hopper, possibly because it was so similar in concept to the homebrew receiver he himself had used as a boy ham a quarter of a century earlier.

Dad did not consider the Ocean Hopper's AC/DC operation to be a convenience feature, but rather a safety hazard. Fearful that his 12-year-old son's fingers might carelessly come in contact with the receiver's hot chassis, he constructed a wooden cabinet to take the place of the one I was unable to afford at the time of purchase. A hobbyist woodworker, Dad's skilled craftsmanship produced an enclosure that gave my Ocean Hopper the look of a piece of fine furniture. This is one of the things I found so interesting and coincidental about N8VZ's initial question about the radio and its cabinet.

My reply to Carl's e-mail related the story of the radio's purchase at Allied and how it came to have that non-factory cabinet. He also mentioned a matching wooden coil rack, which I did not remember but also did not discount having. My memory is sometimes crowded with the many radios that have passed through my hands and occupied space in my shack since that first Knight-Kit receiver.

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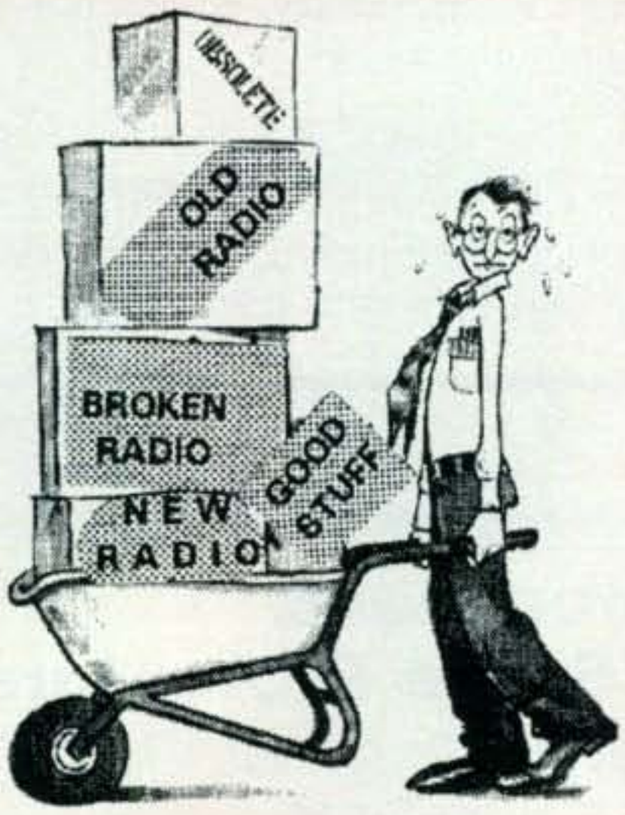

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Ocean Hopper while visiting with Dad. Up until then, the day had not been a particularly good one, at best a 5 on a 1-to-10 scale. I watched the fog of recent months part. I saw light come into his eyes as if they were bringing the events of nearly 48 years ago into sharp focus. Without prompting, Dad talked animatedly of our trip to Allied Radio, the construction of the Ocean Hopper kit, and the wire antenna he helped me put up in the back yard. He recalled his concern over the set's AC/DC circuit and the cabinet he made for it. Our day moved rapidly upscale. It had started as a 5, but reached a 10 as far as I was concerned. That this progression was radio-related did not surprise me at all. Amateur radio has kept the two of us in touch over the years. It has done so in a literal sense when we lived in different places—sometimes on different continents. It has kept us in touch in deeper ways as well. On this particular afternoon, it allowed us to reach out and touch across a gap that has become increasingly difficult to span.

I last remember having my Ocean Hopper in 1960 or '61. I think it was part of a group of things I traded in at Satterfield Electronics in Madison, Wisconsin, or I may have swapped it to one of my young ham buddies in Green Bay. Curious about where it has been all these years, I decided to try tracing it backwards from Carl's purchase. It turns out the immediate previous owner was Karl Ayer, N9PXE, of Mequon, Wisconsin. That puts the receiver back in the right state, but when I contacted Karl, what he had to tell me cast doubt on the radio's being the same one I built. He had gotten the Ocean Hopper from the west coast. It was in poor condition and did not have a cabinet. The wooden cabinet on that receiver now owned by Carl (N8VZ) and the coil rack were both made by Karl (N9PXE). My call became associated with the radio in a roundabout way.

Karl obtained a manual for the Ocean Hopper from Harry Blesy, N9CQX, of Hinsdale, Illinois. My call was written on the documentation, no doubt a relic of the period of time when I owned a Hopper. The paperwork with my call went to N8VZ when Karl sold the radio to him. Harry, N9CQX, remembered his transaction with Karl, but I was unable to backtrack on information he provided about a couple of Ocean Hoppers he had sold. The sales took place several years ago, and the trails have long since grown cold. At the very least, Harry had the instruction/construction manual that went with my original Knight-Kit. At one time he may have had the radio as well. It's impossible to tell now or know where it might have gone.

The Ocean Hopper Carl got from Jim, K8DHW, is lost to the ages as well. After serving as his first shortwave receiver, its chassis played host to a number of construction projects before disappearing entirely. His recent purchase on eBay started a new phase of Ocean Hopper ownership, initiated our correspondence, and provided the genesis for this column.

In Closing . . .

This story would end best with Carl's receiver being the very kit I bought and built, with my call scratched on the chassis and my fingerprints all over the knobs. There are ways in which it could still be my Ocean Hopper, but they require twists and turns that cannot be documented, missing links that cannot be filled in. Most likely it is a different radio, but I would not trade away the experiences of recent days nor the opportunity to relive those of the past. *Wherever* it is, that old Ocean Hopper has repaid my $15 investment of grass-cutting money many times over.

Dave Ishmael, WA6VVL, was kind enough to let me photograph his Model 749 Hopper for the illustration accompanying this column. I'm grateful as well for the assistance he provided in researching the whole Ocean Hopper line. If you have an Ocean Hopper restoration in the works or are just interested in the breed, Dave has resources available you may find helpful. For an article containing complete information on the receiver, as well as restoration from start to finish, point your web browser at <http://members.cox.net/daveishmael/OH.htm>. Additional details on the Ocean Hopper and other vintage gear have been combined into an anthology that is available at <http://members.cox.net/daveishmael/VA.htm>. Dave's e-mail address is <daveishmael@cox.net>.

Whether it's assisting with a radio restoration or cultivating the aluminum farm in the back yard, ham friends are remarkably generous with their time and help. Thanks to my fellow members of the Birmingham Amateur Radio Club, Jerry, N4JF, Jim, W4ATK, and Gene, K4NWU, for taking a Saturday to put the finishing touches on an antenna project here at K9OCO. We all followed instructions from Ken, KT4KI, who ran the show from the top of the tower.

73, Joe, K9OCO

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New class of *Near Legal Limit*™ amplifier gives you 1300 Watt PEP SSB power output for *60%* of price of a full legal limit amp! 4 rugged 572B tubes. Instant 3-second warm-up, plugs into 120 VAC. Compact 14½Wx 8½Hx15½D inches fits on desktop. 160-15 Meters. 1000 Watt CW output. Tuned input, instantaneous RF Bias, dynamic ALC, parasitic killer, inrush protection, two lighted cross-needle meters, multi-voltage transformer.

HF Amps with Eimac *3CX800A7*

AL-800
$1825
Suggested Retail
1 tube, 1250 W

AL-800H
$2695
Suggested Retail
2 tubes, 1.5 kW *Plus*

These HF linears with *Eimac*® 3CX800A7 tubes cover 160-15 Meters including WARC bands. Adjustable slug tuned input circuit, grid protection, front panel ALC control, vernier reduction drives, heavy duty 32 lb. grain oriented silicone steel core transformer, high capacitance computer grade filter capacitors. Multi-voltage operation, dual lighted cross-needle meters.

AMERITRON *full legal limit* amplifiers

AMERITRON legal limit amps use a super heavy duty Peter Dahl Hypersil® power transformer capable of 2.5 kW!

Most powerful / *3CX1500/8877*

AL-1500
$3045
Suggested Retail

Ameritron's *most powerful* amplifier uses the herculean *Eimac*® 3CX1500/8877 ceramic tube. It's so powerful that 65 watts drive gives you full legal output -- and it's just loafing because the power supply is capable of 2500 Watts PEP.

Toughest / *3CX1200A7*

AL-1200
$2645
Suggested Retail

Get ham radio's *toughest* tube with the Ameritron AL-1200 -- the *Eimac*® 3CX1200A7. It has a 50 Watt control grid dissipation. What makes the Ameritron AL-1200 stand out from other legal limit amplifiers? The answer: A super heavy duty power supply that loafs at full legal power -- it can deliver the power of more than 2500 Watts PEP two tone output for a half hour.

Classic / *Dual 3-500Gs*

AL-82
$2545
Suggested Retail

This linear gives you full legal output using a *pair* of *Amperex*® 3-500Gs. Competing linears using 3-500Gs *can't* give you 1500 Watts because their lightweight power supplies *can't* use these tubes to their full potential.

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Use 1 coax for **4** antennas. No control cable needed. SWR <1.25, 1.5 - 60 MHz. Useable to 100 MHz.

RCS-8V Remote Coax Switch. . . $149

Replace **5** coax with 1! 1.2 SWR at 250 MHz. Useable to 450 MHz. < .1 dB loss, 1kW@ 150MHz.

RCS-10 Remote Coax Switch. . . $159

Replace **8** coax with 1! SWR<1.3 to 60 MHz. **RCS-10L, $199.95** with lightning arrestors.

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what's new

BY KARL T. THURBER, JR.,* W8FX

Universal Charger, QRP Project Kits, Beverage Antenna System, and more

This month we'll focus on some noteworthy radio ham shack accessories, antennas and antenna accessories, and other items of timely interest to our readers. Let's dig right in.

Accessories for the Shack

True Universal Charger. W & W Manufacturing Co. is a leading ISO-certified manufacturer of replacement batteries, battery chargers, and battery analyzers for two-way radios and bar-code scanners. Recently introduced by W & W Manufacturing is a unique True Universal Charger (UC) that reportedly will charge all major manufacturers' batteries (photo A).

If the radio utilizes all three chemistries (NiCd, NiMH, and Li-ion), you will need only one adapter cup to charge the various battery chemistries. What makes the firm's UC-series chargers unique is that without any tools you can simply replace the adapter cup and the charger will then charge another manufacturer's radio batteries.

The UC series of battery chargers offered by W & W are available in a single unit (UC-1), as shown in the photo, or in a six-station unit (UC-6). Adapter cups are interchangeable. Charger and analyzer adapter cups are available for land-mobile, cellular, camcorder, and bar-code-scanner batteries.

In addition, the firm's battery analyzers include a new "Rapid Analyzer 1" (not pictured) that will analyze a battery in just 3 minutes. The same adapter cup will analyze NiCd, NiMH, and Li-Ion batteries. Also available are three- and six-station battery analyzers/conditioners that do not feature the "3-minute test." The analyzers are user-friendly and require only a single button to operate.

For more information and product pricing, contact W & W Manufacturing Co., 800 South Broadway, Hicksville, NY 11801-5017 (1-800-221-0732; e-mail: <email@ww-manufacturing.com>; on the web: <http://www.ww-manufacturing.com>).

Vernier Dials by Philmore. Vernier dials, or vernier control knobs, have been a favorite of engineers and QRP radio builders for many years. Now Philmore (which, along with DATAK Manufacturing, is a unit of LKG Industries) has reintroduced its popular group of "verniers," which had been discontinued due to production problems. The Philmore vernier dials mount flush on a panel and they fit a standard 1/4-inch knob shaft, which permits very fine, precise tuning and readout of either potentiometer and/or variable capacitor settings.

Three Philmore vernier-dial types are available. The Model S36 (photo B) is 1.5 inches in diameter and its scale is graduated in units from 0 to 10. The S38 (not shown) is 1.5 inches in diameter, and the S50 (photo C) is 2 inches in diameter; both of these dial types are graduated in units from 0 through 100.

Philmore products are sold via local electronics and parts distributors. For pricing and help in locating a distributor, contact Philmore Manufacturing Company, div. of LKG Industries, Inc., P.O. Box 6386, 3660 Publishers Drive, Rockford, IL 61125-1386 (815-874-2301; e-mail: <lkgindustries@compuserve.com>; on the web: <http://www.philmore-datak.com>).

Four-Pack of QRP Project Kits from Alden McDuffie. Alden McDuffie has announced four

Photo A– Shown here is the new True Universal Charger, the UC-1, from W & W Manufacturing. It will charge all major manufacturers' batteries. If the radio utilizes all three battery chemistries (NiCd, NiMH, and Li-Ion), you will only need one adapter cup to charge the various battery chemistries. (Photo courtesy W & W Manufacturing Co.)

Photo B– Philmore has reintroduced its group of "verniers," including the Model S36 Vernier Dial pictured here. The S36 is 1.5 inches in diameter and its scale is graduated in units from 0 to 10. (Photo courtesy LKG Industries)

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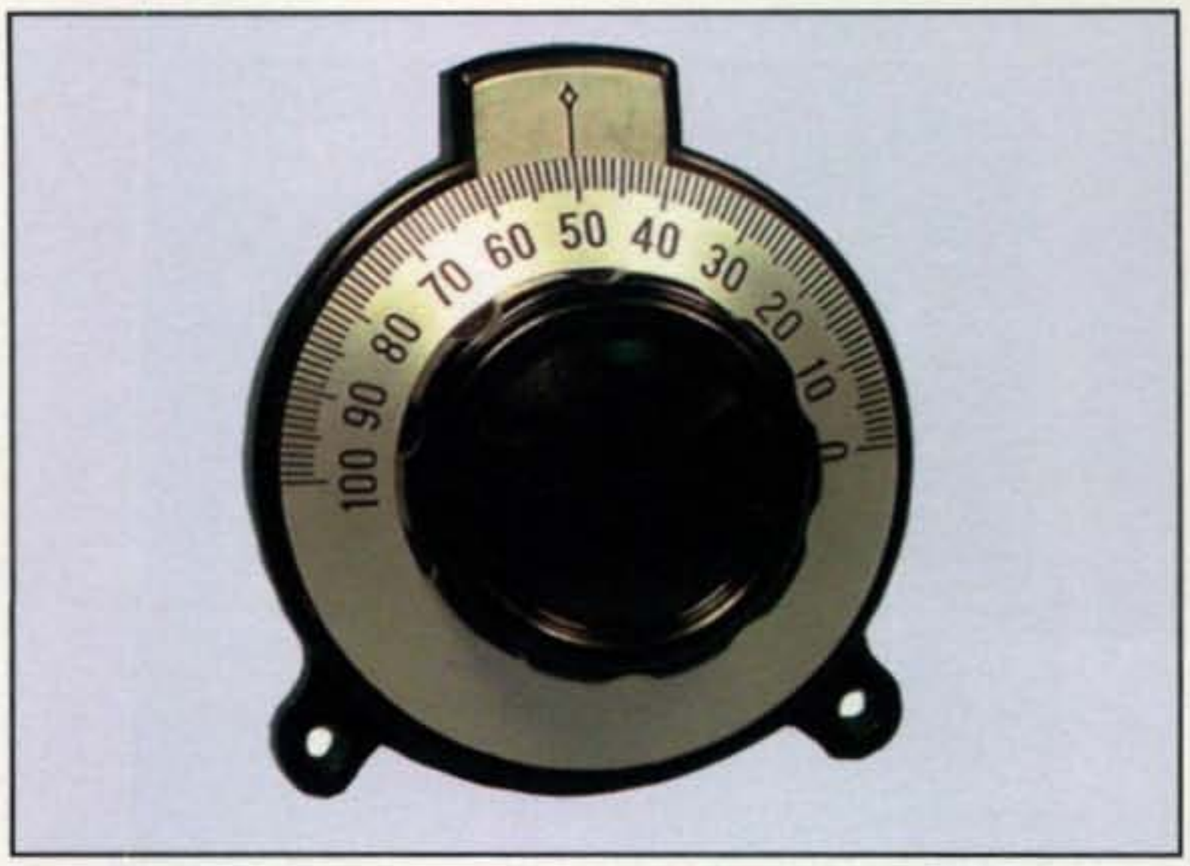

Photo C– Similar to the Philmore Model S36 Vernier Dial is the Model 50, which is 2 inches in diameter; its scale is graduated in units from 0 through 100. Philmore products are sold via local electronics parts distributors nationwide. (Photo courtesy LKG Industries)

inexpensive QRP Project Kits: the Smart Dummy Load, CW Filter, Prototyping Case and PCB, and Audio Signal Generator. All four kits fit the firm's Assistant (aluminum) Case, which measures 3.25" × 4.0" × 1.25". These new products can be purchased assembled or in kit form; the printed circuit board (PCB) only also may be purchased. Each kit is accompanied by a step-by-step manual, along with a schematic and bill-of-material (BOM).

First up is the Smart Dummy Load (photo D). This dry load handles 10 watts and includes an internal coaxial switch. It's said to be ideal for checking your QRP rig's output. Powered by a 9-volt battery, the load is "smart" in that it prevents the operator from changing coaxial switch status when RF is present, thus protecting the rig and the relay points in the switch. The dummy load includes a built-in coax switch, "CW" spot switch, and key line.

Next up is the CW Filter (photo E). The output circuit of this 500-Hz filter, with a 750-Hz center frequency, includes an LM386 audio amplifier with internal pot for directly matching the audio level from the radio, allowing filter/no-filter comparisons simply by pushing a button. The 8-pole Chebyshev filter draws less than 12 ma.

Third up is the Prototyping Case and PCB (photo F). This new kit is designed to save you time on your next QRP project. The kit includes case, PCB with "dead bug" construction area and pads/layout for an SO-239 antenna connector, two 3.5-mm audio jacks, and two alternate-action switches. The step-by-step manual assists you in building the kit and in planning for your project. The manual includes case mechanical drawings, schematic, and BOM for the PCB.

Last up is the Audio Signal Generator (photo G). This kit reportedly is ideal for checking out homebrew QRP rigs, audio filters, and amps, as well as for testing an existing rig's audio. The PCB fits in the Project Case and is powered by an internal battery or an external +12-volt bench supply. The generator produces a 1 Vpp (volt peak-to-peak) maximum, digitally generated sine wave from 0.5 to 10 kHz when driving a 600-ohm load.

Contact Alden McDuffie Inc., P.O. Box 3636, Lawrence, KS 66046 (phone 785-766-0404; e-mail: <info@aldenmcduffie.com>; on the web: <http://www.aldenmcduffie.com>). Confirm

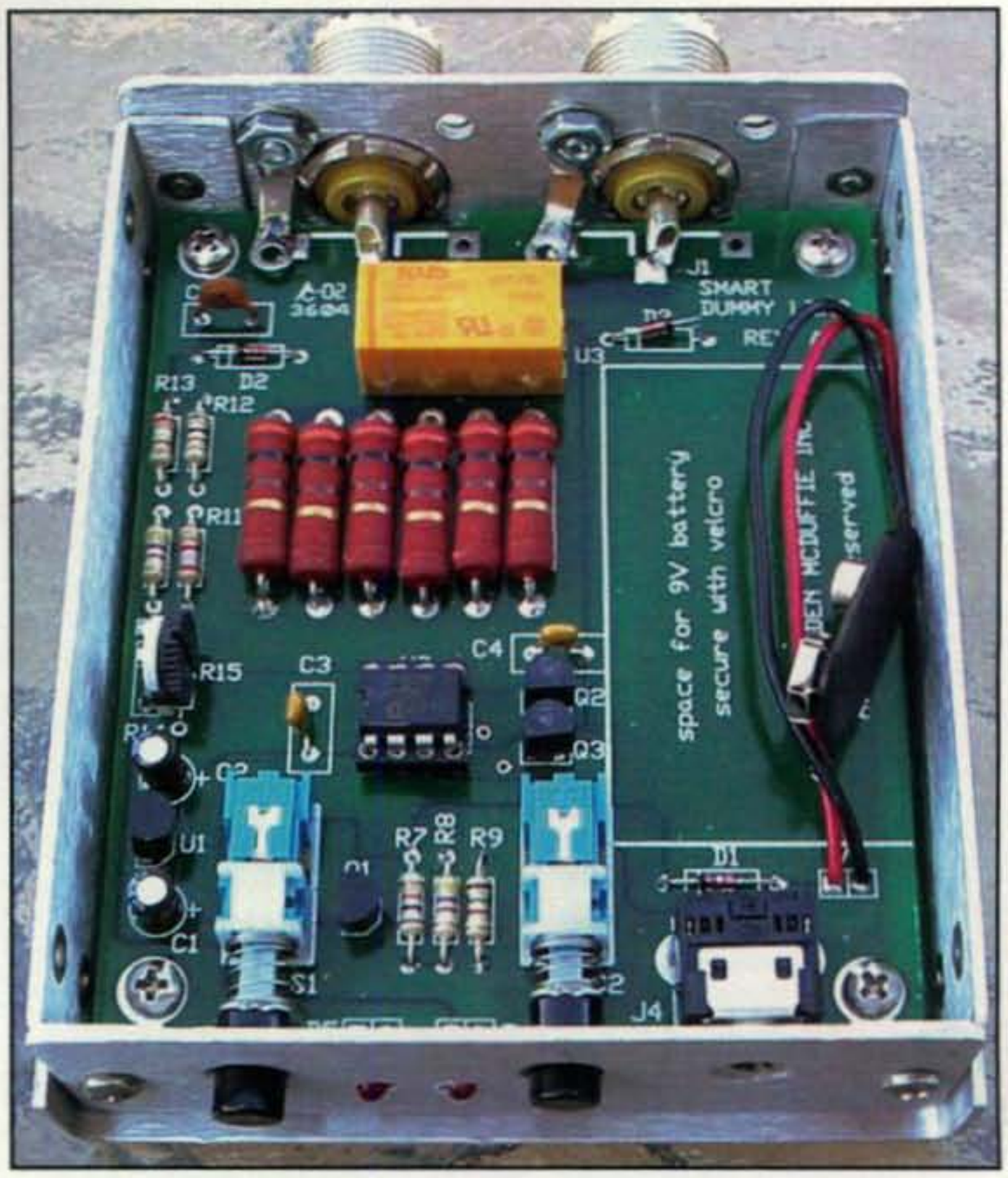

Photo D– The Alden McDuffie Smart Dummy Load is said to be ideal for checking your QRP rig's output. The load is "smart" in that it prevents the operator from changing coaxial switch status when RF is present. The load handles up to 10 watts. (Photo courtesy Alden McDuffie)

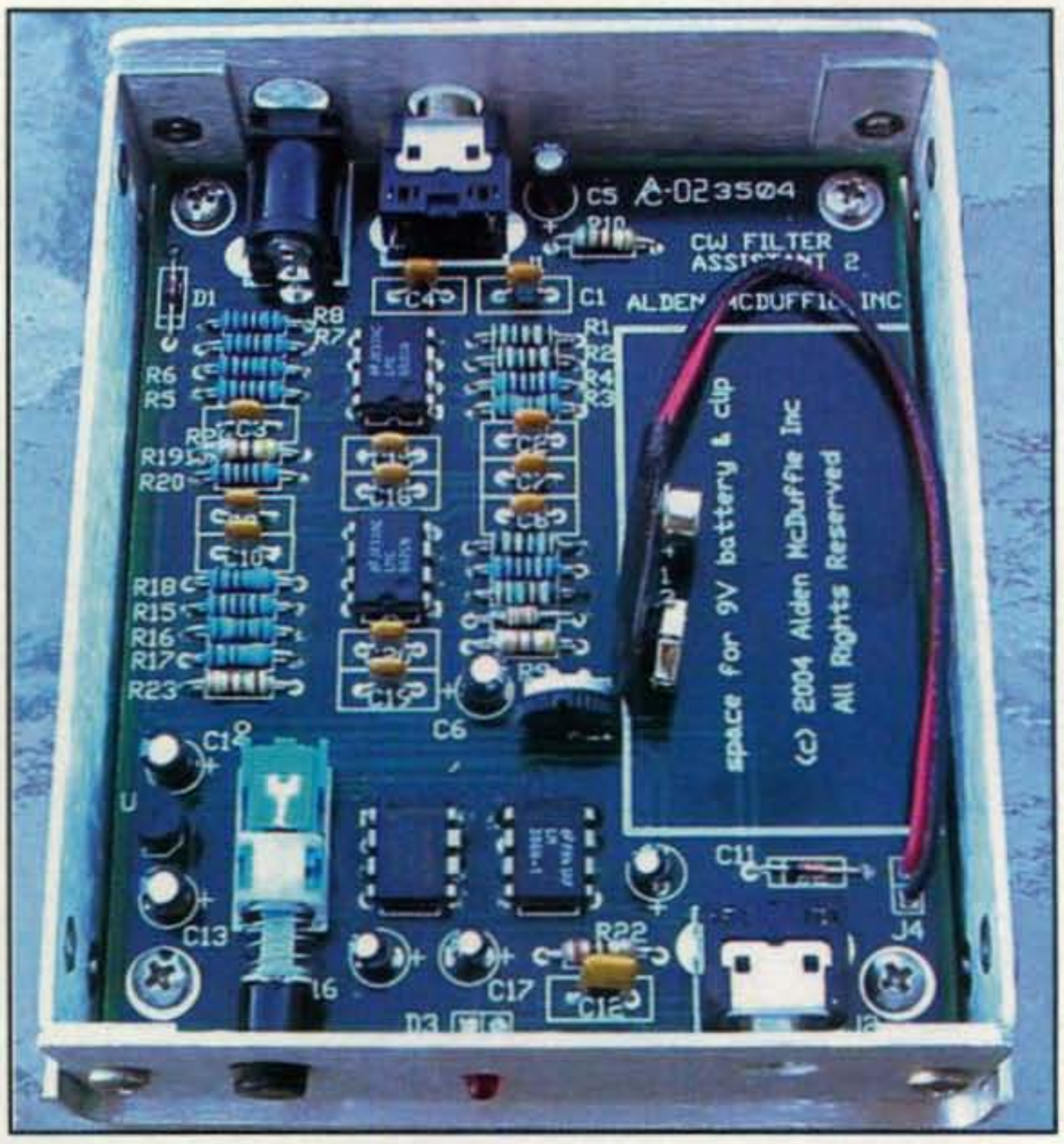

Photo E– The Alden McDuffie CW Filter is affordable as an outboard filter for homebrew QRP or commercial (such as the IC-703) rigs. The filter fits between your rig and speaker/phones, and the PCB is powered by an internal 9-volt battery or external +12-volt supply. (Photo courtesy Alden McDuffie)

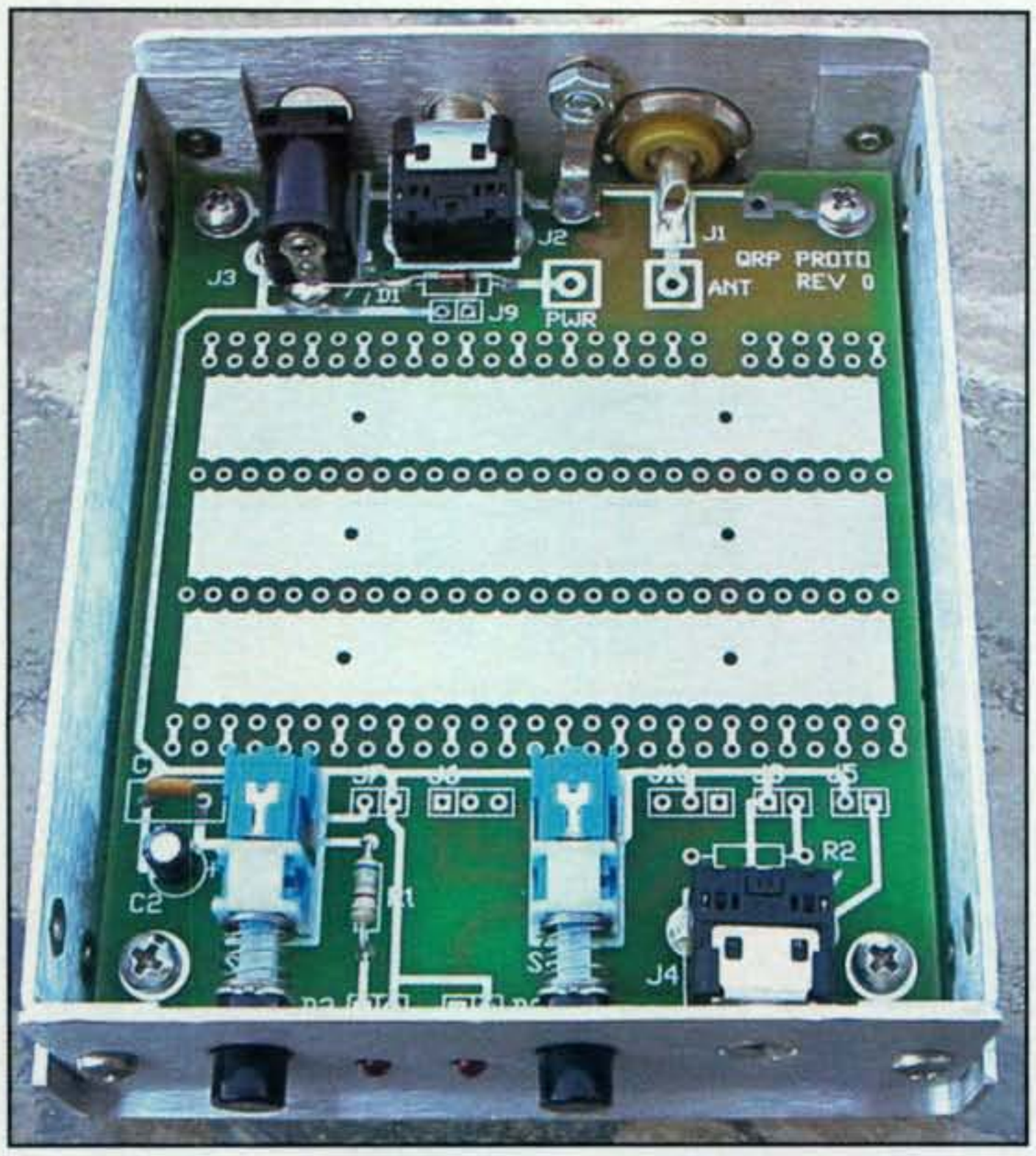

Photo F– The Alden McDuffie Prototyping Case and PCB is designed to save you time on your next QRP project. The step-by-step manual assists you in building the kit and planning for your project. (Photo courtesy Alden McDuffie)

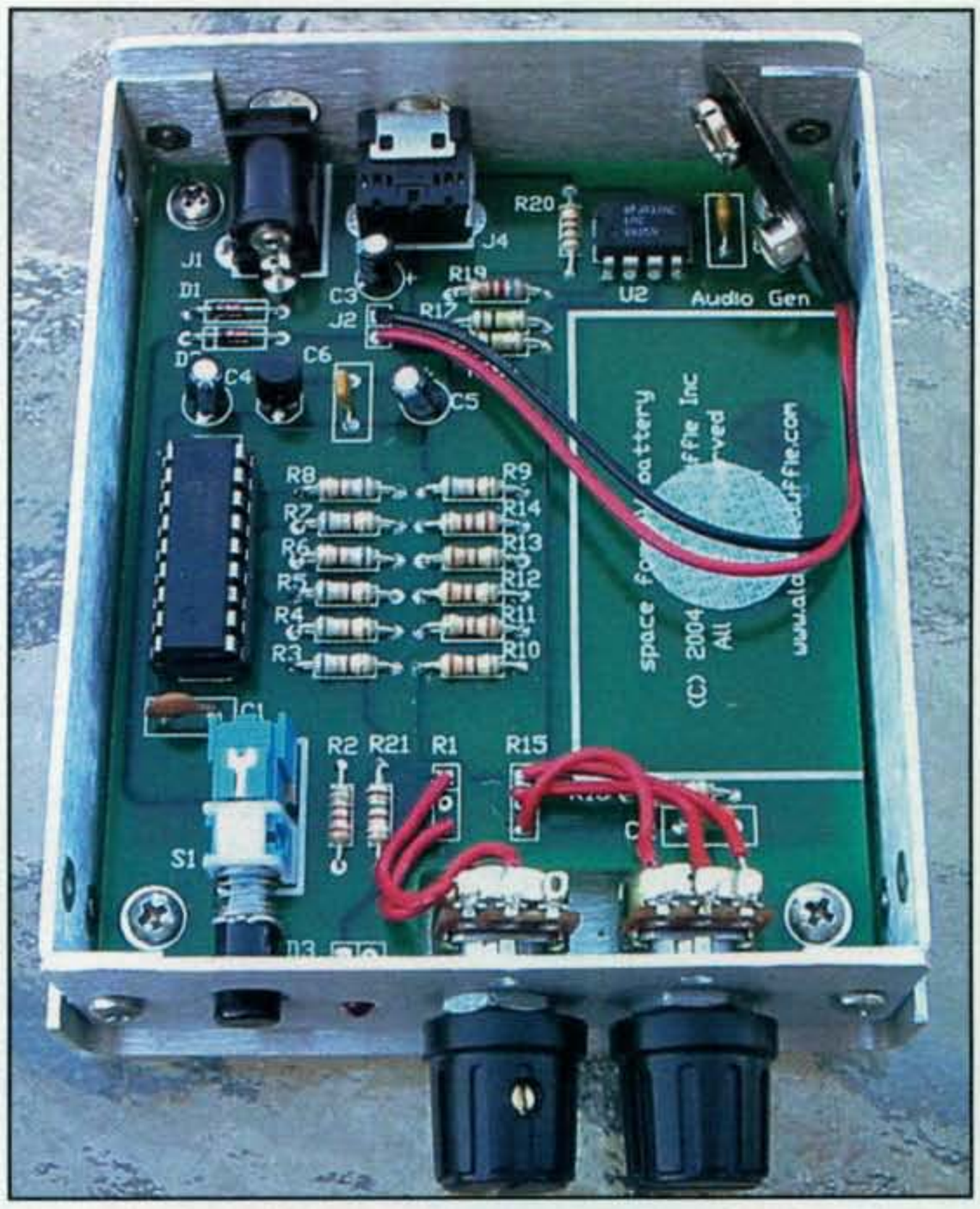

Photo G– The Alden McDuffie Audio Signal Generator reportedly is ideal for checking out homebrew QRP rigs, audio filters, and amps, or for testing a rig's audio. PCB fits in the firm's Project Case and is powered by an internal battery or an external +12-volt bench supply. (Photo courtesy Alden McDuffie)

current pricing and availability options on the website, which helpfully offers kit manuals for download.

Switching Power Supply for Ameritron ALS-600 Amplifier. The ALS-600-SPS Switching Power Supply (photo H) is a lightweight supply for use with the Ameritron *ALS-600* No-Tune Solid-State Amplifier. The new power supply weighs much less than the choke-type power supply originally packaged with the amplifier. The specially designed switching and filter circuits reportedly make the power supply RF hash-free.

The ALS-600-SPS has a terminal strip where the AC voltage can be set to 120 or 240 VAC at 50/60 Hz. The power supply will operate safely from 90–130 VAC in the 120 VAC position, and 185-260 VAC in the 240 VAC position. Output is 50 VDC, 25 amps (±14 VDC @ 1 amp). The unit has cross-needle metering for voltage and current, and the output connector is a Beau multi-connector with a 6-foot cord to mate with the ALS-600 amplifier. The AC line is a NEMA 5-15P connector.

This new Ameritron switching power supply weighs only 10 pounds and measures a super-compact 6"H × 9"W × 14 1/2"D. Constructed like the ALS-600 amplifier, the new power supply is covered by Ameritron's one-year limited warranty. The ALS-600-SPS alone is $629 MSRP; the ALS-600 amplifier and ALS-600-SPS power supply combination is $1428.

Contact Ameritron, 116 Willow Rd., Starkville, MS 39759 (1-800-713-3550; e-mail: <ameritron@ameritron.com>; on the web: <http://www.ameritron. com>).

Antennas and Antenna Accessories

RBS-1P Reversible Beverage Antenna System from DX Engineering. DX Engineering's new RBS-1P Reversible Beverage Antenna System (photo I) allows you to build a two-wire, reversible Beverage antenna system with superior signal-to-noise ratio, which is particularly useful at lower frequencies such as 160 and 80 meters. The RBS-1P, which consists of the Feed Point Matching Unit and the Reflection Transformer, allows two Beverage antennas receiving in opposing directions to share the same space.

The RBS-1P has one antenna port terminated so that both antennas share a common feedline. Applying 12 to 15 VDC to the feedline switches between the antennas and also switches the direction of reception. The user can use both antennas simultaneously by feeding two receivers with a separate feedline for each antenna. Isolated grounds prevent common-mode noise and unwanted signals, and the unit will not be damaged by nearby transmitters.

Other features include air gaps, wide foil traces for increased lightning protection, and 75-ohm Type F connectors to support high-quality buried feedline. While the RBS-1P is optimized to use 450-ohm ladder line for the antenna element, the system will work with any 300- to 600-ohm two-wire antenna. The price is $129.

Contact DX Engineering, P.O. Box 1491, Akron, OH 44309 (telephone 1-800-777-0703; e-mail: <dxengineering@dxengineering.com>; and on the web: <http://www.dxengineering.com>).

MFJ High-Efficiency Loop Tuners™ and Full-Legal-Limit Fully Balanced Antenna Tuner. With the MFJ High Efficiency Loop Tuner™, two variations of which are shown in photo J, you can drape a wire around a bookcase and attach both ends to the tuner. The wire instantly turns into a small, high-efficiency multiband transmitting loop antenna!

DC Power Distribution

ALL THE FEATURES - LESS $$$

- Anderson PowerPole Connectors
- Rated for 30 Amps
- ARES/RACES Standard Connection
- RF Suppression
- Surge & Polarity Protection
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- Made in the U.S.A.

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PowerPanel 8

PowerPanel 6

PowerPanel 4

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- One-Year Warranty
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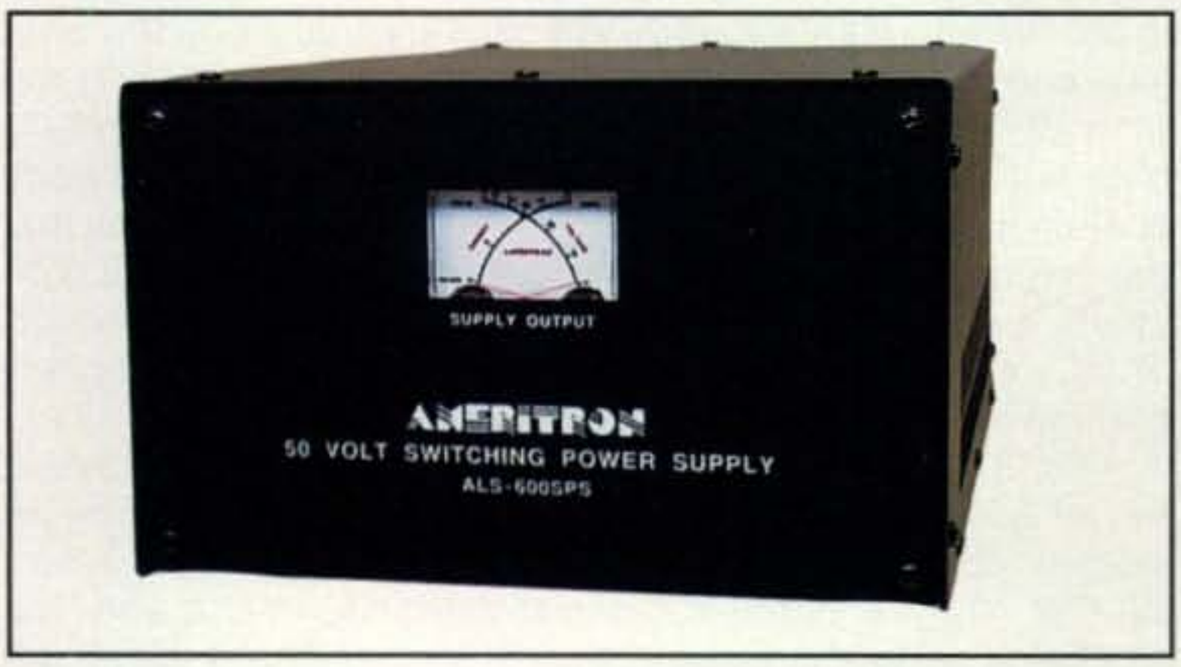

Photo H— The Ameritron ALS-600-SPS Switching Power Supply for the ALS-600 No-Tune Solid-State Amplifier is a lightweight switching power supply. The new unit weighs much less than the choke-type power supply originally packaged with the amp. (Photo courtesy Ameritron/MFJ)

According to the manufacturer, no ground, radials, or counterpoises are needed, and you can operate 7 to 30 MHz with a full 150 watts. You can tune any shape loop: circle, square, rectangle, or any odd shape, although reportedly a quarter-wavelength wire shaped as a circle is the most efficient. Exact frequency coverage depends on wire length, loop shape, and the environment.

The new tuner also is said to be a very quiet receiving antenna. Its high-Q design rejects out-of-band interference, and it reduces overloading and harmonics. It's excellent for apartments, antenna-restricted areas, and portable operation. The tuner has an MFJ low-loss Butterfly loop tuning capacitor, with no rotating contacts (available separately as MFJ-19, $69.95). The built-in RF antenna current ammeter is used for tuning.

The MFJ-936 Small High Efficiency Loop Tuner is priced at $249.95 and is for home stations; it has a more efficient air-wound inductor, heavier components, and larger meter. The MFJ-935 Mobile High Efficiency Loop Tuner, at $199.95, is for portable and home stations; it's smaller and lighter than the MFJ-936.

While we are discussing new tuners, we also should mention the MFJ-976 Full Legal Limit Fully Balanced Antenna Tuner (photo K). The new $499.95 tuner is said to offer superb current balance, very wide matching range (12–2000 ohms), and continuous 1.8–30 MHz coverage, including all WARC bands. The unit handles 1500 watts SSB and CW.

A major feature is MFJ's fully balanced, extremely wide-range T-network, which offers simple, fast, three-knob tuning. The tuner has a true active peak-reading, lighted, cross-needle SWR/wattmeter that lets you read SWR as well as true peak or average forward and reflected power at a glance. Another feature is the unit's excellent 10-meter performance, said to be the result of MFJ's low minimum capacitance and the exclusive Self-Reso-nance Killer™ high-Q AirCore™ roller inductor with silver-plated contacts. A heavy-duty 1:1 current balun is designed to stay cool, even at high power levels. All tuners are covered by MFJ's famous No Matter What™ one-year limited warranty. Under it, MFJ will repair or replace (at its option) your tuner, no matter what, for one full year.

For more information or a free catalog, contact MFJ Enterprises, Inc., 300 Industrial Park Rd., Starkville, MS

Photo I– DX Engineering's RBS-1P Reversible Beverage Antenna System lets you build a two-wire, reversible antenna system with superior signal-to-noise ratio. The system, consisting of the Feed Point Matching Unit and the Reflection Transformer, allows two Beverage antennas receiving in opposing directions to share the same space. (Photo courtesy DX Engineering)

Photo J— The MFJ-935 and MFJ-936 High-Efficiency Loop Tuners™ are designed for apartments, antenna-restricted areas, and portable operation. The MFJ-936 (on the bottom) is for home stations. The MFJ-935 (on top) is for portable and home stations; it's smaller and lighter. (Photo courtesy MFJ Enterprises)

Photo K– The MFJ-976 Full Legal Limit Fully Balanced Antenna Tuner offers superb current balance, very wide matching range (12–2000 ohms), and continuous 1.8–30 MHz coverage. The unit handles 1500 watts SSB and CW. (Photo courtesy MFJ Enterprises)

39759 (1-800-647-1800; e-mail: <mfj@mfjenterprises.com>; <http://www.mfjenterprises.com>).

Short Bursts

What's New Column Contributors Still Welcome! We've asked before, and we'll ask again: Are you offering for sale a new product you'd like to tell us about and share with CQ readers? Do let us know what you're up to. While a polished, professionally prepared new product announcement or formal "press release" would certainly be welcome, one isn't necessary for an announcement of your product to appear in our "What's New" column. We can help you along the way. You can contact the "What's New" column by e-mailing me at <w8fx@cq-amateur-radio.com>. Just be sure to carefully note our disclaimer, which you'll find at the tail end of each column, just after the "Wrap-Up." The disclaimer tells you that the column listings are not product reviews and do not constitute a product endorsement by *CQ* or your column editor. Thus, we typically report on new products, but we don't review them in the column.

Also, if you think your new product might be a candidate for an advertisement in *CQ,* whether large or small, by all means contact *CQ*'s Advertising Manager, Don Allen, W9CW. You'll find that it's easy to advertise in *CQ,* and Don can help you develop a winning ad. Contact Don at telephone 217-344-4570, fax 217-344-4575, or by e-mail to <ads@cq-amateur-radio.com>.

Wrap-Up

That's all for this time, gang. Next time more "What's New." See you then.

Overheard: While having a good memory is very important, some would say that the ability to forget is really precious.

73, Karl, W8FX

Note: *Listings in "What's New" are not product reviews and do not constitute a product endorsement by CQ or the column editor. Information in this column is primarily provided by manufacturers/vendors and has not necessarily been independently verified. The purpose of this column is to inform readers about new products in the marketplace. We encourage you to do additional research on products of interest to you.*

AT-100Pro MEMORY Automatic Antenna Tuner

Tunes with SSB... Just key the mic and speak!

NEW!

Only $219

The **AT-100Pro** is a full featured, frequency sensing, memory autotuner designed for today's HF radios. It features dual antenna connectors with over 2000 memories for each. Latching relays reduce power consumption and hold the match even with DC power removed. Tunes with SSB. Just pick up the mic, speak, and it tunes!

The **AT-100Pro** uses LDG's standard high efficiency, microprocessor controlled, switched "L" network and works with dipoles, verticals, inverted Vees and other coax fed antennas. Use with the optional 4:1 or 1:1 external baluns for long wires or ladder line fed antennas. Optional interface cables provide DC power and control from most Icom, Alinco, Kenwood and Yaesu radios.

AT-100Pro Features

- 160 through 6 Meters
- 1-125W SSB/CW
- Tunes 6-1000Ω Loads (6-4000Ω w/optional RBA-4:1 Balun)
- LED Bargraphs Show Power, SWR and Status
- 12.5 or 125W Power Scales
- Fully Tunes in 0.5 to 6 Sec (<0.2 Sec for Memory Tune)
- >2000 Memories for Each Antenna Output
- Automatic and Semiautomatic Tune Modes
- Operates on 11-16 V DC at ≤500mA
- 7.5" X 5.5" X 2", 1.5 pounds

Optional Accessories

Remote Baluns. Use with long or random wires and antennas fed with ladder line.
RBA-4:1, 4:1 Balun – **$30**
RBA-1:1, 1:1 Balun – **$30**

Icom Interface. Provides tuner control and DC power to LDG Autotuners.
IC-1/AC-1 (10 feet long) – **$20**
IC-2/AC-1 (1 foot long) – **$8**

Intelligent Radio to LDG Autotuner Interface. Provides tuner control and DC power.
Kenwood K-OTT – **$59**
Yaesu Y-OTT – **$59**
Yaesu Y-ACC – **$12**

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Prices and specifications are subject to change.

our readers say

Blending Radio and Basic Science

The following letter was addressed to Sean Barnes, N3JQ, guest columnist of the "Magic in the Sky" column in the January 2005 issue of CQ:

Sean:

As an early sponsor of the "Big Project," I agreed with the premise that we needed to develop interest and involvement in amateur radio in the middle and high school years. Jim Haynie and the ARRL have done excellent work in developing and launching their program.

I was very impressed with your approach of blending radio with basic science (physics, astronomy) courses. It seems that your requirement for contacts is the secret incentive for the kids to get grades *and* their callsigns. I was delighted to see you using the ARRL Education program; other participants in the program could learn from some of your best practices.

Not All Schools are the Same

Editor, *CQ*:

I just love reading about schools that have been successful in getting ham radio in their school and how many students have become licensed ("Magic in the Sky," *CQ*, January 2005). The thing that gets me upset is that almost all of them are small private schools where the students come from homes where the parents support their children and the school.

I teach in a public school in the Houston area, and back in 1999 I started working on getting ham radio in to the classroom of my middle school. I was able to get a grant from Bloomberg and even got a 70 ft. tower given by a member of TDXS (Texas DX Society). With the help of some hams in B-VARC (Brazos Valley Amateur Radio Club), we got the tower and beams up. My class size has been around 28 to 30 and I have three classes each day. We are on the block system, which means I only have each class every other day.

Then the guys discover soccer football and girls. The girls discover the same thing except its boys. My school is a lower socioeconomic school where over 90% get free meals every day and almost all students live in apartments. Then the principal changed and I can no longer get into the school after hours where I had a few (kids) who would come by. I also have several ask why go to the trouble when there was nothing (similar) at the high school.

I like what Sean did with the computer information. I think I am going to try that way and see if it might help. I only have my students for one semester and then I get a whole new group. This does not help. ... I upset some hams here when I told them that I was going to make my students DXers and contesters. But this is what the young children do best. They are very competitive and will work at it for a while but then move on to other things, as their attention spans are not very long.

Thanks for letting me blow off some steam.

Frosty, K5LBU

W2VU responds:

Frosty—Before I came to *CQ* in the early 1990s, I spent four years as an education producer for CBS News, visiting successful and innovative programs around the country. What I saw time and again was that socioeconomic levels are far less important to the success of any innovative program than the support of parents and principals. I remember visiting a school in the South Bronx which was doing wonderful things despite having very little money available. I also remember going to a well-to-do suburb in Indiana and seeing a storage room filled with computers that the school had purchased but nobody had yet figured out how to use as educational tools. What a waste!

When a principal creates and supports an atmosphere in which innovation is encouraged, and when parents are involved and interested in their children's education, nearly anything is possible. Without that support, however, teachers looking "outside the box" find mostly frustration. Good luck with adapting Sean's program to your school; perhaps you can find some more support out there.

antennas

BY KENT BRITAIN,* WA5VJB

Measuring Antenna System Performance plus a 222-MHz "Cheap Yagi"

I have spent a lot of time lately reading old articles on measuring antenna gain. One particularly interesting one was a 1939 article on measuring the gain of one of those newfangled Yagi antennas. The strange part was the unusually high gain numbers they were seeing: 13 dBd is certainly better than I've ever seen out of a 4-element Yagi.

The tests were being made on 20 meters, so the antennas were pretty big and the elements were made of wire strung between poles. Two dipoles were set up as shown in fig. 1, with the transmitter connected to one dipole and a power meter to the second. Next they added a reflector and measured the power increase, followed by a director and then a second director, ending up with the configuration seen in fig. 2. Wow, power increases by a factor of 20! That's 13 dB gain from only a 4-element Yagi!

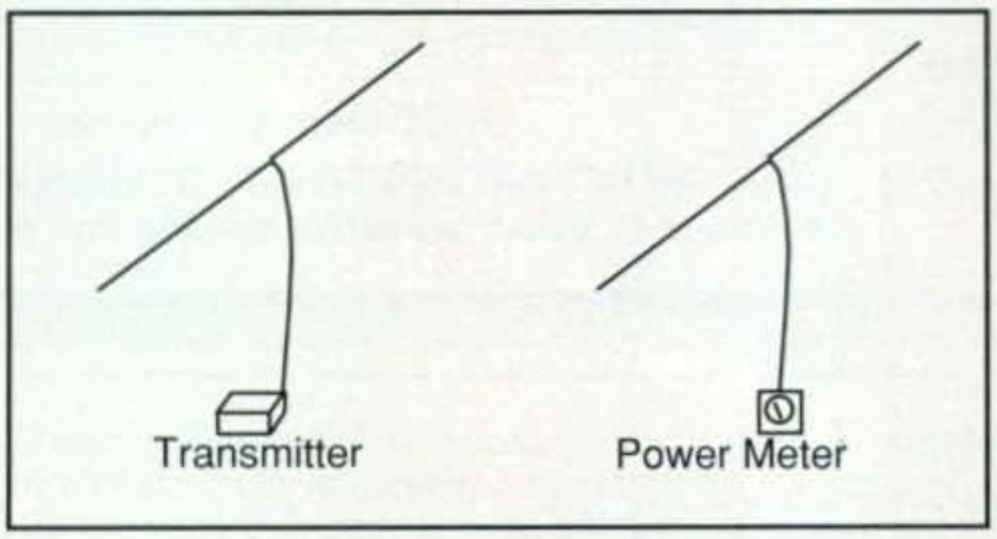

Fig. 1– Early attempts to measure the gain of a Yagi antenna started with setting up two dipoles, one attached to a transmitter and the second to a power meter. A base reading was taken on the power meter before elements began being added (see fig. 2).

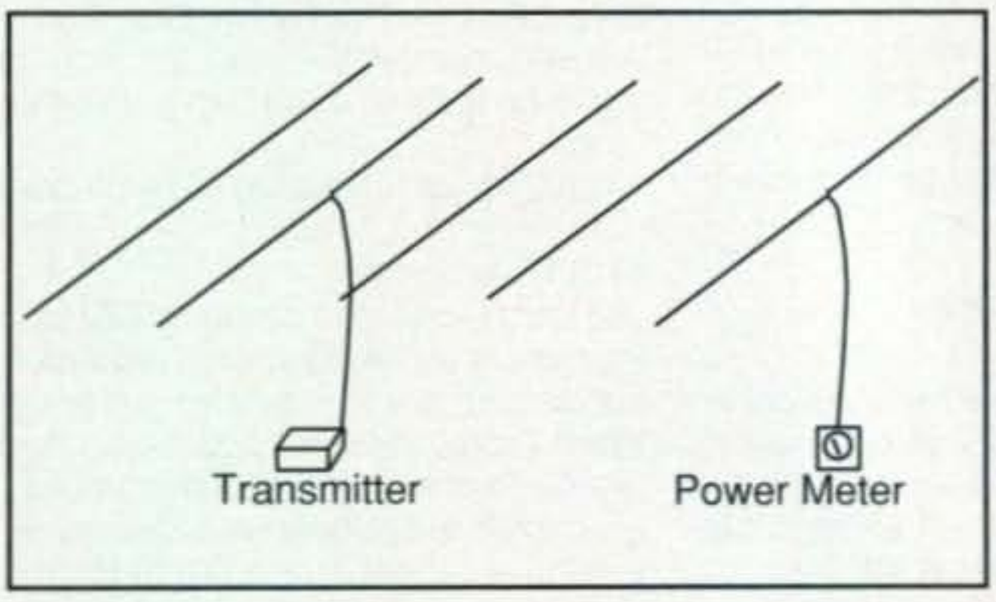

Fig. 2– After the base reading was taken, additional power measurements were made after the addition of a reflector, then one director, then a second director. As explained in the text, the proximity of the receive antenna made the measurements invalid.

*1626 Vineyard, Grand Prairie, TX 75052
e-mail: <wa5vjb@cq-amateur-radio.com>

dB Return Loss	SWR
–10 dB RL	2.0:1
–20 dB RL	1.22:1
–30 dB RL	1.06:1
–40 dB RL	1.02:1

Table I– Comparison of Return Loss vs. SWR.

Of course, they were way too close and the receive antenna was acting more like the fifth Yagi element than a free-space dipole. However, this is only one of the pitfalls in antenna measuring.

Ten years later, Mr. Moore, developer of the quad antenna, made some similar mistakes doing his Quad vs. Yagi measurements. This has filtered down though the years as the famous statement that "Quads have 2 dB more gain than Yagis." A more correct statement would be that Moore's Quad had 2 dB more gain than Moore's Yagi, but the Quad vs. Yagi comparison was not made on a level playing field. But we'll be going over antenna gain measurement a lot more in a future column.

SWR vs. Return Loss

Measuring the SWR of an antenna is a technique that goes back to the early days of wireless communication. A technician would turn on the transmitter and walk along the open wire feedline (coax was still many decades in the future) measuring voltage. AC voltage was a simple enough measurement. As he walked feedline, he would take a voltage measurement every few feet. For this example, let's say he measures 10 volts right at the transmitter. Along the feedline he measures 10 volts, 10 volts, 10 volts, 10 volts, etc. His highest voltage is 10 volts, his lowest voltage is 10 volts, thus his highest/lowest is 10/10 or 1, giving him an SWR, or standing-wave ratio, of 1:1 and a transmission line that has "flat" readings. However, when the antenna has some reflections creating a standing wave, then the voltage readings will vary. This time the technician reads 10 volts at one point and 5 volts at another. Now his standing-wave ratio is 10/5 or 2:1. If he measures 15/5 volts, then the SWR is 3:1. While a standing wave can create some high-voltage hot spots, it's the nulls where the voltage gets near zero that give SWR readings near infinity. This problem doesn't exist today, but remember that—like coaxial cable—the directional coupler, the heart of the modern SWR bridge, was still some decades away.

Return Loss

In the engineering world today, it is more common to express SWR as dB Return Loss (RL). A directional coupler is used to measure forward power,

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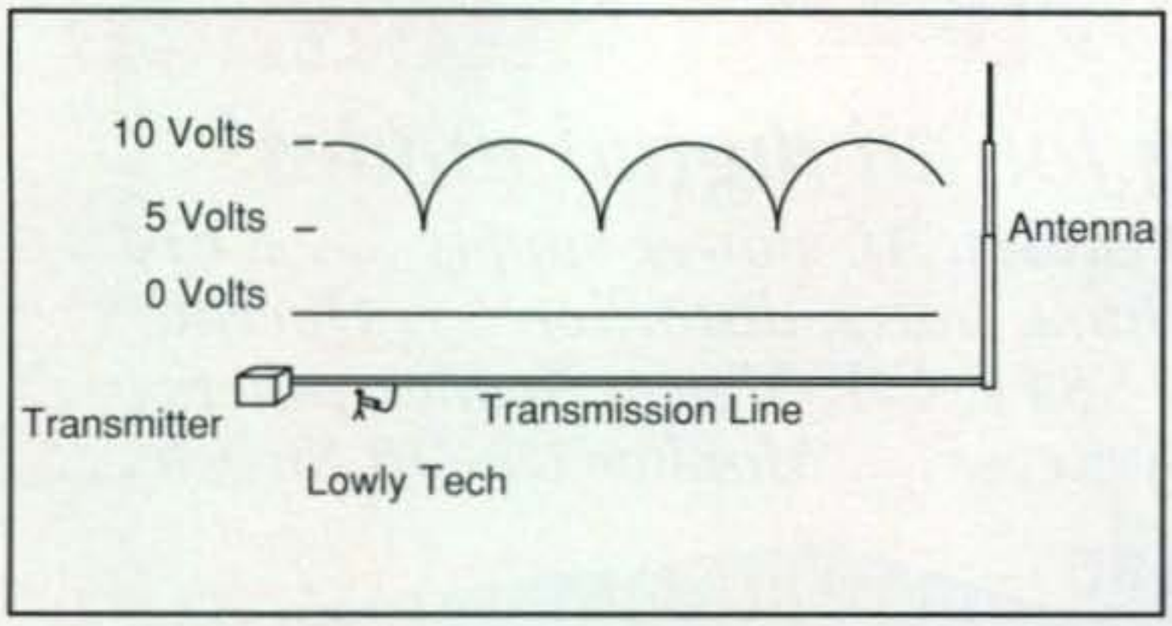

Fig. 3– Measuring SWR the old-fashioned way. A technician would walk along the transmission line taking AC voltage readings. (See text for details.)

then reversed in the line (or a second coupler has been conveniently installed in the reverse direction) and the reflected power is measured. If the reflected power is 10 dB less than the forward power, then the load has –10 dB return loss (see Table I).

For you guys who still own an HP 415E with its slotted line, yes I've rounded things off a bit, but the idea is show just how clumsy a system SWR is to work with. Before World War II, SWR was a fairly simple measurement that only required a voltmeter, but dB Return Loss is far more practical. As an example, let's say I improve the input SWR on an expensive instrumentation amp from 1.06:1 to 1.045:1. That doesn't tell me a whole lot, but expressed in dB return loss, these same numbers say I've improved the return loss from –30 dB to –33 dB; –3 dB is half the power, so I have cut the reflected power in half.

This Month's Construction Project

If you're a new *CQ* reader, you're probably wondering what you're seeing in photo A. If you've been around for a few years, you're probably thinking it's about time he got around to a 222-MHz version of the infamous "Cheap Yagi." Well, here it is, and it's an antenna that has given out a lot of grid-square points in VHF contests.

You can see in photo B that the boom is drilled so I can mount it vertically for FM or leave it in its usual horizontal position for SSB. With a narrow band such as 222 MHz, the same antenna works well on both the 222.1-MHz SSB calling frequency or in the FM portion of the band.

With the family of Cheap Yagis, the impedance of the driven element is controlled by the loading effects of the other elements. Thus, gamma matches, baluns, shorting bars, etc., are eliminated. Also, since the coax is directly soldered to the driven element, there are no joints to corrode and even the coax connector is eliminated. The coax shield is soldered near the middle of the top rod, while the center conductor is soldered near the tip of the J (see photo C).

I am also trading off about 1/2 dB of gain to broaden the bandwidth of the antenna and clean up the pattern. Thus, you don't have to build everything to the exact .001 inch for this antenna to work well.

There are a lot of materials you can use to make the reflector and director elements. My favorite is RadioShack ground rod wire. About $5 will get you 40 feet of element material. Other material that has been used successfully includes #10 copper wire, welding rod, hobby tubing, and even aluminum-element material. In one case, I even used plastic tubing filled

Photo A– 222-MHz "Cheap Yagi."

Photo B– Mounting holes for vertical or horizontal mounting.

Photo C– The coax attachment points for the 222-MHz "Cheap Yagi."

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Number of Elements		Reflector	Driven Element	Directors D1	D2	D3	D4
3	Length (in.)	26.0	*	23.75	—	—	—
	Spacing (in.)	0	5.5	13.5	—	—	—
4	Length	26.25	*	24.1	22.0	—	—
	Spacing	0	5.0	11.75	23.5	—	—
6	Length	26.5	*	24.1	23.5	23.5	21.0
	Spacing	0	5.0	10.75	22.0	33.75	45.5

**See fig. 4 for driven element dimension.*

Table II– Element dimensions and spacings for the 222-MHz "Cheap Yagi." All dimensions are in inches and the reflector and directors are made from 3/16-inch diameter material. Spacings are all from zero with the reflector being the zero point. If you want to build this antenna using 1/8-inch material, simply make the reflector and directors .1 inch longer to compensate for the thinner element material.

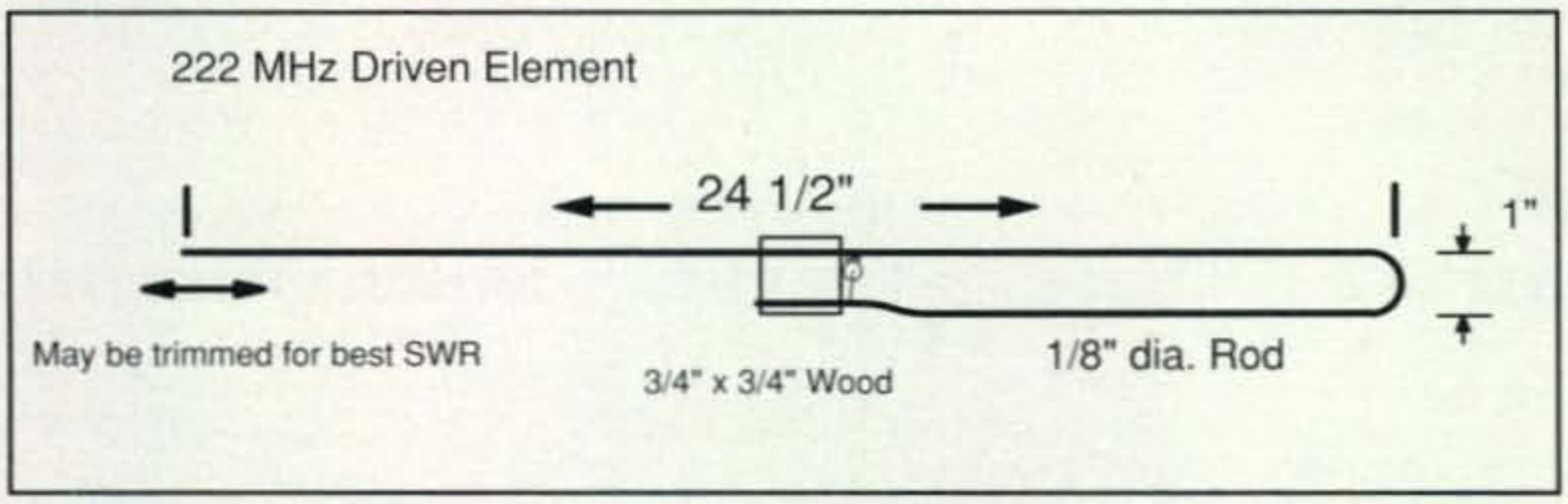

Fig. 4– 222-MHz driven element.

with salt water, but we'll save that story for another time. The elements can be held in place with a drop of Super Glue, RTV, or my favorite, Liquid Nails.

For temporary use or just rovering to a couple of grids, bare wood is fine for the boom. However, a quick coat of spar varnish, one of the wood protectors, or even house paint will greatly extend the antenna's life when mounted outside. My ATV receive antennas have been mounted inside my attic for 11 years now and still give good performance, so they don't have to always go outside. I am not of fan of PVC as the boom material, but there have certainly been a lot of Cheap Yagis made with PVC booms.

The same driven element is used on all three versions of the 222-MHz "Cheap Yagi," I used 1/8-inch silicon bronze welding rod, but #10 or #12 copper wire may also be used. The free end of the J can be trimmed for best SWR on your favorite frequency.

In photo D, you can see the sliding tube over the end of the driven element. Computer programs do not model this J driven element well, so I just trim the driven element a tad short, slide over the tube, then slide it in and out for best Return Loss/SWR. A quick solder joint holds it in place. The length of the dri-

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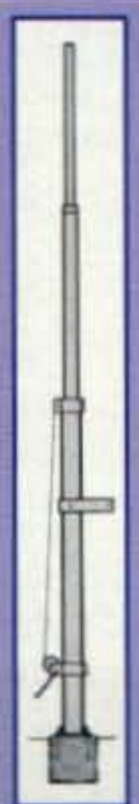

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MAST MODEL	MAX. HT.	MIN. HT.	WT. (LBS.)	50 MPH (sq. ft.)	70 MPH (sq. ft.)	LIST PRICE	SALE PRICE
MA-40	40'	21'6"	242	16.5	6.8	$1,209	$1,099
MA-550	55'	22'1"	435	22	9	$1,875	$1,699
MA-550MDP	55'	22'1"	620	22	9	$3,584	$3,249
MA-770	71'	22'10"	645	15.5	5.5	$3,091	$2,799
MA-770MDP	71'	22'10"	830	15.5	5.5	$4,890	$4,449
MA-850MDP	85'	23'6"	1128	15.3	6.3	$6,591	$5,999

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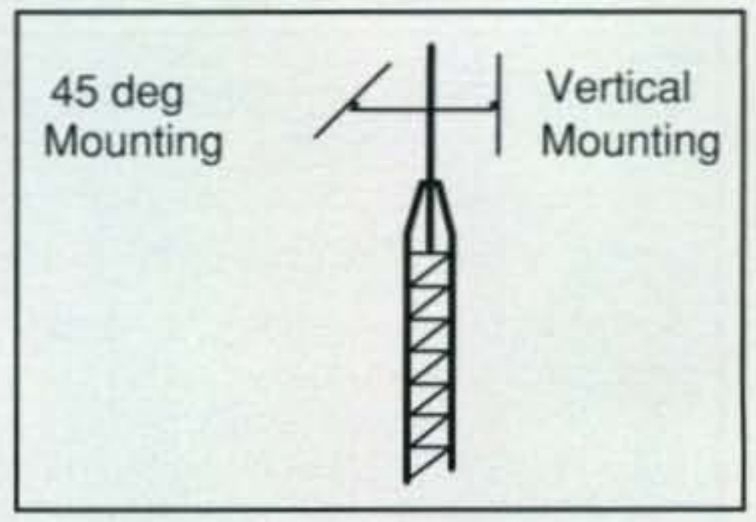
Antenna Size	Typical Gain	Typical Front-to-Back Ratio
3 element	8 dBi	24 dB
4 element	9 dBi	23 dB
6 element	11 dBi	25–30 dB

Table III– Antenna performance figures for 222-MHz "Cheap Yagi."

Photo D– Detail of the sliding tube used for tuning the driven element on the 222-MHz "Cheap Yagi."

Fig. 5– Mounting a Yagi so it can be used easily on both FM and SSB. →



ven element is experimentally determined and this is the dimension in the construction notes.

Twenty-five years ago I was part owner of several 220-MHz (yep, it was 220 not 222 back then) repeaters, and one of the three single sideband 220-MHz stations in the 5th call area. My suburban tower space was at quite a premium, so instead of installing separate SSB and FM beams, I installed one Yagi at a 45-degree angle (see fig. 5). This cost me 3 dB of gain on the repeaters and 3 dB of gain on SSB, but it worked great for four years. So if you've got one of those multiband, mulitmode rigs, this would be a way to use that Yagi on both 2-meter FM and SSB.

More to Come in May

So what shall it be next time? First I'll try to cover many of the techniques we have used at the Central States VHF Society antenna contests to measure the gain of antennas. Second will be to take advantage of the ability to change the impedance of a "Cheap Yagi" by changing its element spacing to come up with a family of 72-ohm ATV receive antennas. Between now and then, get some aluminum in the air!

73, Kent, WA5VJB

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SS-18	15	18	1⅛ x 6 x 9	3.6
SS-25	20	25	2⅞ x 7 x 9⅝	4.2
SS-30	25	30	3¾ x 7 x 9⅝	5.0

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SRM-25	20	25	3½ x 19 x 9⅝	6.5
SRM-30	25	30	3½ x 19 x 9⅝	7.0

WITH SEPARATE VOLT & AMP METERS

MODEL	CONT. (Amps)	ICS	SIZE (inches)	Wt.(lbs.)
SRM-25M	20	25	3½ x 19 x 9⅝	6.5
SRM-30M	25	30	3½ x 19 x 9⅝	7.0

MODEL SRM-30M-2

2 ea SWITCHING POWER SUPPLIES ON ONE RACK PANEL

MODEL	CONT. (Amps)	ICS	SIZE (inches)	Wt.(lbs.)
SRM-25-2	20	25	3½ x 19 x 9⅝	10.5
SRM-30-2	25	30	3½ x 19 x 9⅝	11.0

WITH SEPARATE VOLT & AMP METERS

MODEL	CONT. (Amps)	ICS	SIZE (inches)	Wt.(lbs.)
SRM-25M-2	20	25	3½ x 19 x 9⅝	10.5
SRM-30M-2	25	30	3½ x 19 x 9⅝	11.0

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beginner's corner

BY WAYNE YOSHIDA,* KH6WZ

Mobile HT or HT Mobile?

Extending the Value of Your Radio Gear

I have to confess that I am sort of a miserly guy. In the not so distant past I did not have a lot of money to spend. Back then I was being "frugal by force." The other day, though, one of my sisters called me "cheap," because I have the money nowadays but do not spend it.

In any case, I have always tried to maximize the value of everything I own. This is especially true of "luxury" or "play" things such as tools and ham radio gear. As beginners, we might want to start out by trying simple stations and equipment to see if we like what we are doing, and then upgrade gear as operating interests and bank balances grow.Thus, here is a way to increase the value of your first few pieces of ham radio gear—the portable VHF/UHF FM "handie-talkie," or HT, and the mobile transceiver.

If you have one of these items, I will show you how to transform one unit so that it can do "double duty" as the other, extending the value of whichever type of radio you have. If the only ham radio set you presently own is an HT, you can make it into a viable mobile transceiver. Likewise, if you only have a mobile rig, I will show you how to turn that into a portable radio, or what I call a "luggie-talkie," or LT.

The Luggie-Talkie for Portable and Field Use

Let's start with the LT, since it is probably the most intriguing. How does one turn a "car radio" into a portable system? Remember when "laptop computers" were too heavy to sit on your lap? An old saying went something like "just put a handle on it, and you can call it 'portable.'"

These days most single- and dual-band (sometimes more-band) VHF and UHF mobile rigs are almost as small as HTs. They are perhaps shaped for use in a vehicle, but they can be turned into a portable radio setup. The LT is actually smaller than some commercially available portable transceivers from decades past. For example, old timers may recall the compact, portable 2-meter transceiver called the "Twoer" from Heathkit (photo A). The nickname for this early LT is "Benton Harbor Lunchbox," because the Heath Company was located in Benton Harbor, Michigan, and because of the handy carrying handle on the top. Several versions were available for different bands. One issue with calling it portable, though, is that the Lunchbox rig is AC-operated. *(Actually, one available option for the Lunchboxes was a 12-volt DC vibrator power supply for mobile if not portable use. Noisy but effective.—ed.)*

Today's lunchbox radio could be made with a small mobile rig, a battery and a suitable charger,

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Photo A– On the left is a "Benton Harbor Lunchbox" for 2 meters, perhaps one of the first "luggie talkies" (LTs). On the right is a modern-day LT made with a tiny mobile transceiver and a gel-cell/charger.

and an antenna. My LT is used for public-service communications and as a liaison radio when microwave contesting. Used in the lowest power setting (5 watts), the system can easily run for several days powered by the 7-Ah gel-cell inside a surplus 12-volt uninterruptible power supply (UPS). Of course, battery life depends on the amount of transmitting you do. If you listen more than you talk, battery life increases. The 12-volt UPS keeps the battery charged when not in use, so the system is always ready to go in an emergency or whenever I need portable communications with lots of operating power. This rig is used with either a magnet-mount mobile antenna, or a homemade "squishy ground plane" antenna made with No. 12 copper wire. As a bonus, the 12-volt power system can also be used with a "normal" HT for extended battery operation.

The Mobile HT

Although you can simply use an HT in the car as

Photo B– The coax lead and the connector may outweigh your HT, so it would be good idea to have a small and very flexible cable between your HT and mobile antenna.

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is, it is very wise to make your mobile setup as safe as possible. With a few accessories the HT mobile station can also be made more effective, so you will be able to communicate with a stronger, more reliable signal. The HT mobile idea makes a great back-up station and can also come in handy when traveling in a rental car.

First, do not allow the power and antenna cables to get in the way of the steering wheel and pedals. Fasten the rig securely in some way so that acceleration and braking will not make the rig into a flying missile. Pre-program the memory channels and get to know your radio well enough to operate it blindfolded so you will not need to take your eyes off the road while operating. An even safer practice would be to minimize or eliminate manipulating the radio while driving.

A safety-related accessory needed for HT mobile operation is the external speaker-microphone. Using a speaker-mic will allow you to securely fasten the radio to the seat, or some other stationary object, and will provide more audio so you can hear the receiver better. Most speaker-mics have a clip mounted on them, so I make use of this feature by clipping the unit to the shoulder belt when I drive. This minimizes fumbling around to find the microphone and also brings the speaker closer so you can hear the receiver better. Just remember to unclip the unit from your chest before you get out of the car.

Next we should figure out how to make the rubber-flex antenna that came with your HT more effective while being used as a mobile station. Actually, in this application the best bet is to put away the antenna that came with your unit and use some sort of vehicular antenna mounted outside the vehicle cabin.

A magnet-mount antenna is one of the fastest, easiest, and not-too-bad-in-performance systems available. I have tried various temporary mobile antennas and prefer magnetic-base or trunk-lid-mount, rather than on-glass antennas. If the magnetic base you have is a used unit or is old, make sure that the magnet is nice and strong, because it is possible that the unit may "let go" as you are driving along the highway. This is dangerous, because if the antenna flies off the car, the antenna may pull the HT out of your hands. Lightly closing the window on the cable is one way to take care of this.

Speaking of the antenna cable, you should try to minimize stress on the antenna connector to avoid breakage. Because a mobile-radio antenna cable and its connector usually are rather large, a small and very flexible "interface cable" should be used between the HT and the antenna lead. See photo B for an example of this HT-to-mobile-radio antenna interface cable.

Photo C shows my HT mobile setup ready to go. Here the HT is placed in the center console and secured with a small Velcro® strap. If the console is "occupied," the radio can be clipped to a clipboard, notebook, magazine, or similar item and then wedged into the seat or some other location, keeping the radio stable while under way. The HT can also be clipped to the seat belt or shoulder strap. Make sure that any controls or buttons (especially the push-to-talk button) will not be moved or pressed accidentally.

At first the HT battery pack can be used for power, but sooner or later you will want to increase your operating time, and using power from the vehicle makes sense. Check the operating manual or the radio manufacturer's literature to see if there is an accessory power cord available. Sometimes the external power

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Photo C– An HT mobile station ready to go. If your HT has an SMA connector, like this Yaesu VX-5, you should use a small and flexible "interface cable" between the HT and antenna cable to reduce torque and connector breakage on the radio.

Photo D– When using an extended antenna on your HT, cradle the antenna and radio carefully to minimize torque on the antenna connector. Note the plastic sleeve covering the base of the antenna to keep your hand from coming into direct contact with the antenna while transmitting.

cords have cigarette-lighter plugs with built-in noise filters. This is the easiest way to get external power into your HT. Make sure a properly-rated fuse is installed in the power cable.

The HT mobile setup can be further improved with a bit more RF power output. A small amplifier "brick" can be used to boost the RF from the HT to a more respectable 25 watts or more. Some amplifiers even come with receiver pre-amplifiers built-in to improve reception as well. Remember that an amplifier like this will require more DC power, probably several amps of current. Go directly to the battery for DC power for the amplifier and you should be safe. Do not forget to include a fuse in the DC line.

Battery and Antenna Ideas for Both Systems

As you increase the value of your equipment by expanding their applications, I am sure you will come up with more ideas to further increase your capability. Here are some of my favorites . . . .

Batteries are always the weakest link in a portable system. There is nothing worse than a dead battery, because it becomes a brick of dead weight that does nothing. I have been supplementing my HT batteries with gel-cells, and if you can handle the increased weight and bulk, they are an excellent way to boost operating time by a huge margin.

When you use gel-cells you will need a way to charge them. Several units are available, from store-bought units to kits. See the References section for more information. You may also want to consider a solar charger for a clean and green (environmentally friendly) charging. Solar panels can be found at marine and automotive parts stores, recreational vehicle dealerships, and hardware and home centers. Check the ads in this magazine or do a quick check online for sources.

Antenna systems can be either homemade or store-bought. Some sort of portable antenna would be especially useful for fieldwork, such as public-service events, camp-outs, or temporary base stations. They must be quickly and easily deployed and, when the event is finished, taken apart and put away. The "squishy ground plane" and the "fire truck J-pole" mentioned in previous "Beginner's Corner" articles are good examples of homemade portable antennas.

Mobile antennas can be adapted to become portable base-station antennas. Some antenna manufacturers make adapters to convert a mobile antenna into a base-station unit. These are essentially ground-radial systems with a way to secure the antenna onto a pole or mast.

"Walk around" portable or LT antennas a little bit more challenging, since they have to be safe (they should not protrude too far and become a spear) as well as effective. The first suggestion for better HT (or LT) performance is just about any commercially made aftermarket antenna that is larger than the standard "rubber duckie." Check the ads in this magazine and ask the staff at your favorite radio store for some ideas. I have a small collection of after-market, gain-type HT antennas, including telescopic whips, extended rubber-flex antennas, and multiple-band types.

If you attach a long antenna to an HT antenna connector, make sure that you do not apply too much force to the antenna, because the torque will very likely break the antenna connector. One way to prevent damage is to hold the radio carefully, cradling the antenna and radio to minimize the force bearing on the antenna connector (see photo D). *(Keep in mind, though, that holding the antenna decreases the efficiency, because some of the RF is going into your hand instead of the air.—ed.)* It would also be a good idea to remove the extra-large HT antenna when not in use.

These hints and tricks will help in-crease the value and flexibility of your equipment and maximize your enjoyment. More important, these hints will expand your communications capabilities if you participate in public-service events and will help you improvise a solution if you need something in an emergency.

73, Wayne, KH6WZ

References

Fire-truck J-pole: "Beginner's Corner," July 2002, page 77.

Squishy ground-plane antenna: "Beginner's Corner," June 2004, page 68.

Gel-cell and charger information: "Beginner's Corner," February 2004, page 68.

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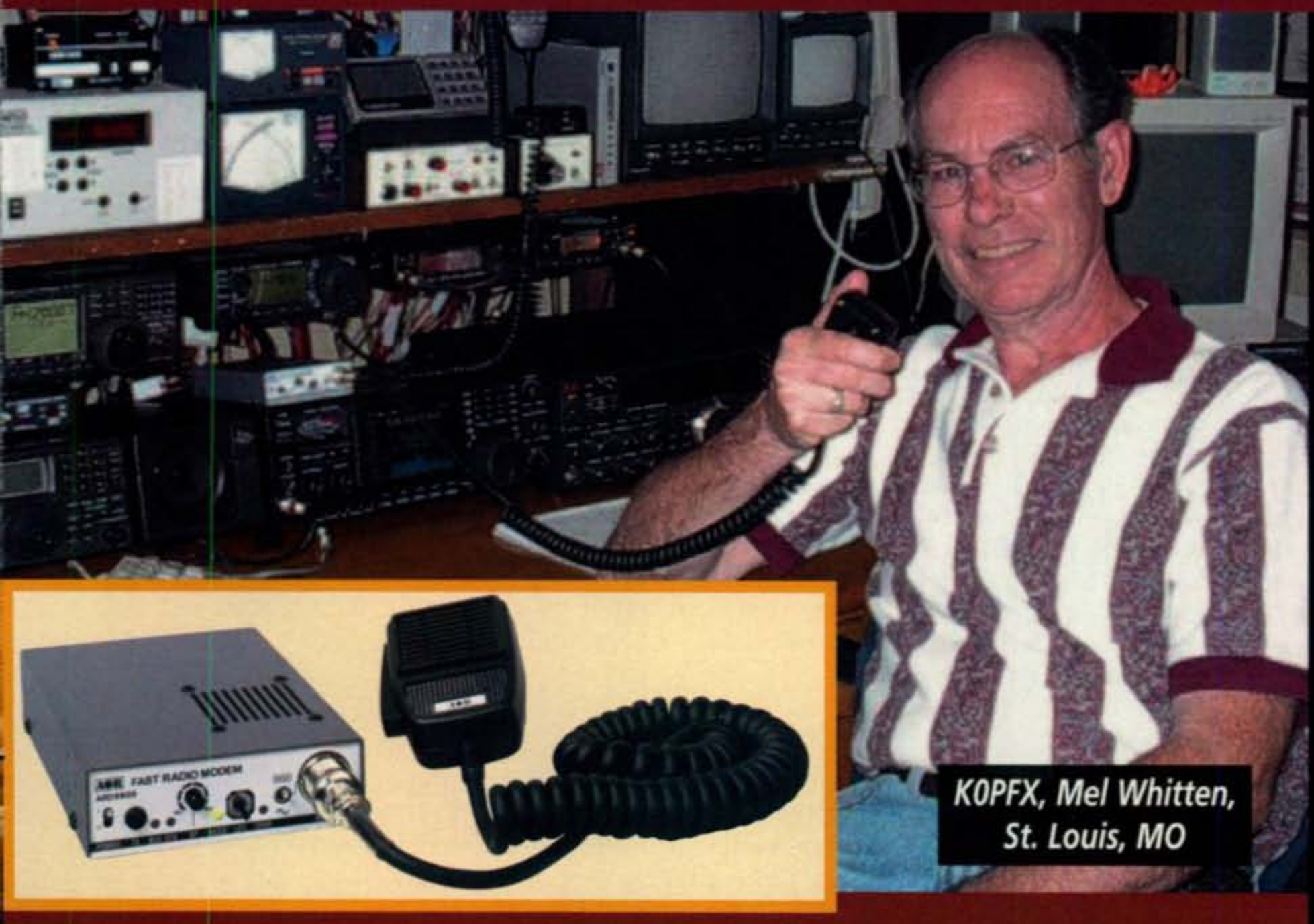

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BY DAVE INGRAM,* K4TWJ

Receivers and Their "Front End" Stages

As you may recall, our previous "How It Works" column presented a general overview of communications-grade receivers and briefly discussed their popular design concepts, such as double and triple conversion. This time we continue with a closer look at the main stages responsible for a receiver's or transceiver's overall sensitivity and strong signal-handling capabilities—RF amplifier, bandpass filters, and first mixer stages. Along with this study, we will include some helpful tips and notes on reading block and schematic diagrams, plus recognizing and comparing unbalanced, balanced, and double-balanced circuits as highlighted in equipment brochures. Although by necessity technical in nature, we will strive to maintain simplicity in this discussion for ease of understanding by amateurs of all backgrounds. Let's begin by considering why one design or circuit arrangement is not directly applicable to all situations or all receivers.

One Size Fits All?

One of the first facts of radio life an amateur learns when operating our HF bands of 160 through 10 meters is that signals, noise levels, and general interference vary on an almost continuous basis. For example, signals on 10, 12, and 15 meters are often low and benefit from pre-amplification, while both signals and noise levels on 160 and 80 meters frequently require less amplification or even attenuation to minimize crosstalk. Our very popular 40-, 20-, and 17-meter bands have a wide mix of signal levels, and they also support the greatest amount of weekend DX and contest activity. You can add to that list solar flares and magnetic storms that change band conditions on an eclectic and even hourly basis. Factor in your own operating preferences and radio needs—such as DXing, contesting, and mobiling—and you will surely agree that asking one receiver or transceiver to perform at its best under such diverse conditions is a big order. However, it can be done. Modern technology is amazing!

Receiver Sensitivity: What is Ideal?

A good communications-grade receiver or HF transceiver should exhibit high sensitivity for copying weak signals, yet avoid overload and crosstalk from high noise levels and QRM. This requirement is addressed in three ways. First, the receiver or transceiver employs one or two front-panel-selectable RF preamplifier stages. Second, it includes a panel-selectable RF attenuator. Third, many rigs include balanced "front end" circuits with only mild gain per stage to produce a low noise figure with good (wide) dynamic range.

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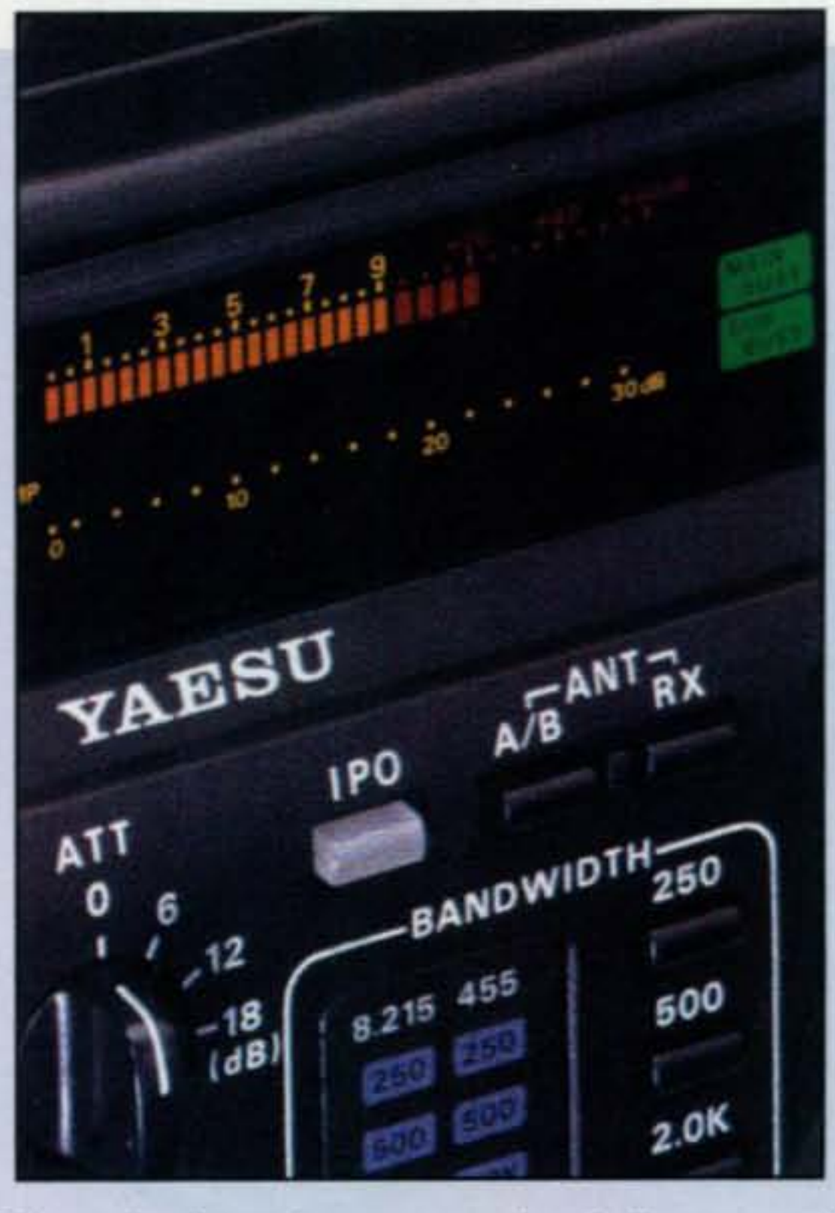

Photo A– A modern transceiver's front-panel IPO, AIP, or RF Preamp button and ATTN switch let you instantly tailor the transceiver's overall sensitivity to mate with band conditions. It is an excellent feature for weak-signal DXing. Just remember to use minimum gain/sensitivity to avoid overload and "buckshotting" when signal levels are high.

An RF preamplifier's front-panel switch may be labeled or designated RF Preamp, AIP (Advanced Intercept Point), or IPO (Intercept Point Optimizations), depending on the rig's manufacturer. The switch adds in or drops out the preamplifier, thus increasing overall RF gain by 10 to 15 dB. In addition, a separate "Attenuator" switch can be used to reduce overall RF gain by 10 or 20 dB. Together these switches tailor receiver sensitivity, noise floor, and dynamic range in a most effective manner. Noise floor, incidentally, is the "background" noise in a receiver's speaker during normal operation. Signals stand out and are easiest to copy when the noise floor is low, and signals are easily masked by noise when the noise floor is high.

Dynamic range refers to the range over which a receiver can copy *weak* signals before they drop into the noise floor and *strong* signals before they produce overload and crosstalk. Would you like to hear how overload and crosstalk sound? Switch on your rig's noise blanker and RF preamp, and tune across 40 or 20 meters on a busy weekend when signals are strong (40 dB over S9 or greater). Notice the "buckshotting" effect. Switch off the pre-

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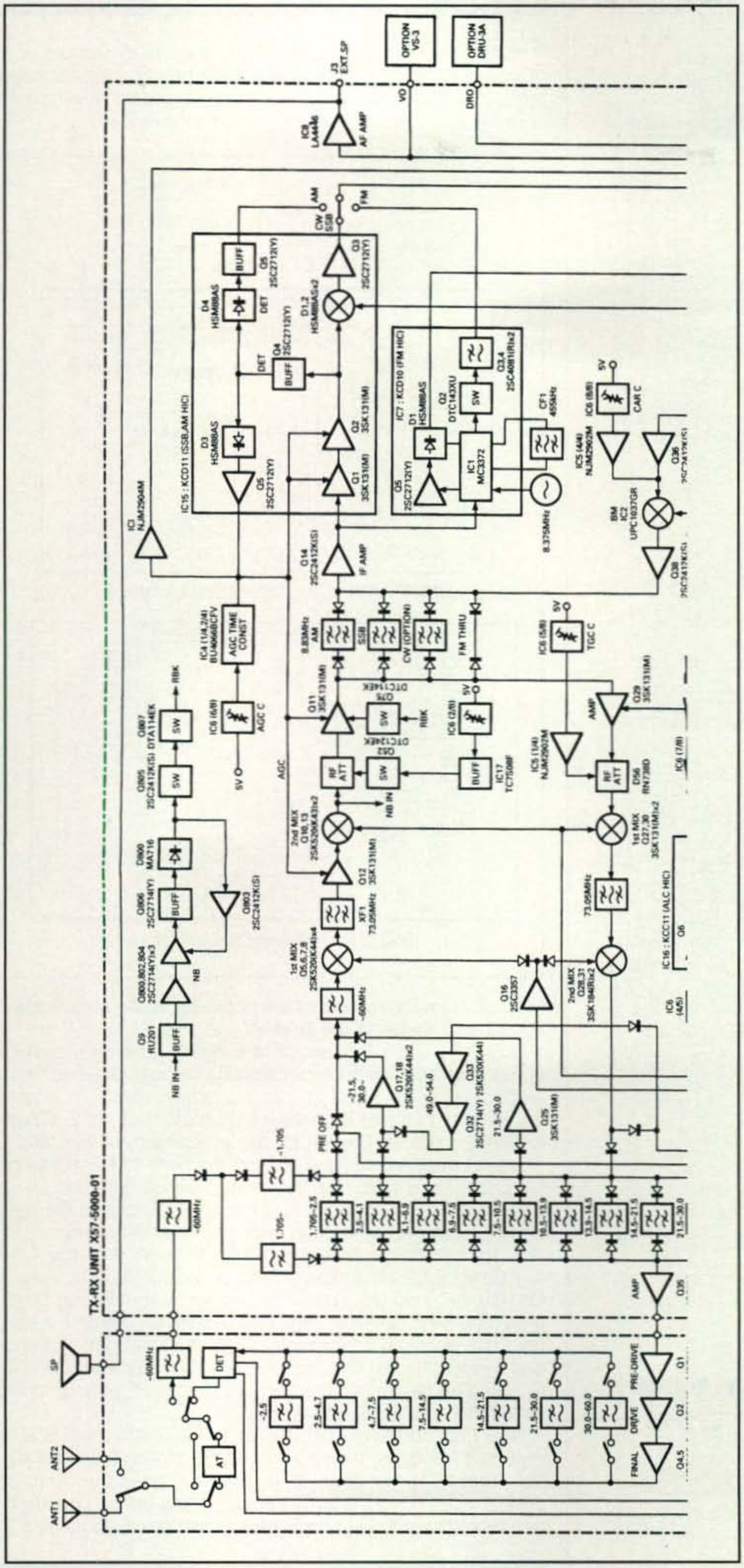


Fig. 1– Block diagram of the popular Kenwood TS-570 transceiver cropped down to fit in this month's column, as discussed in text.

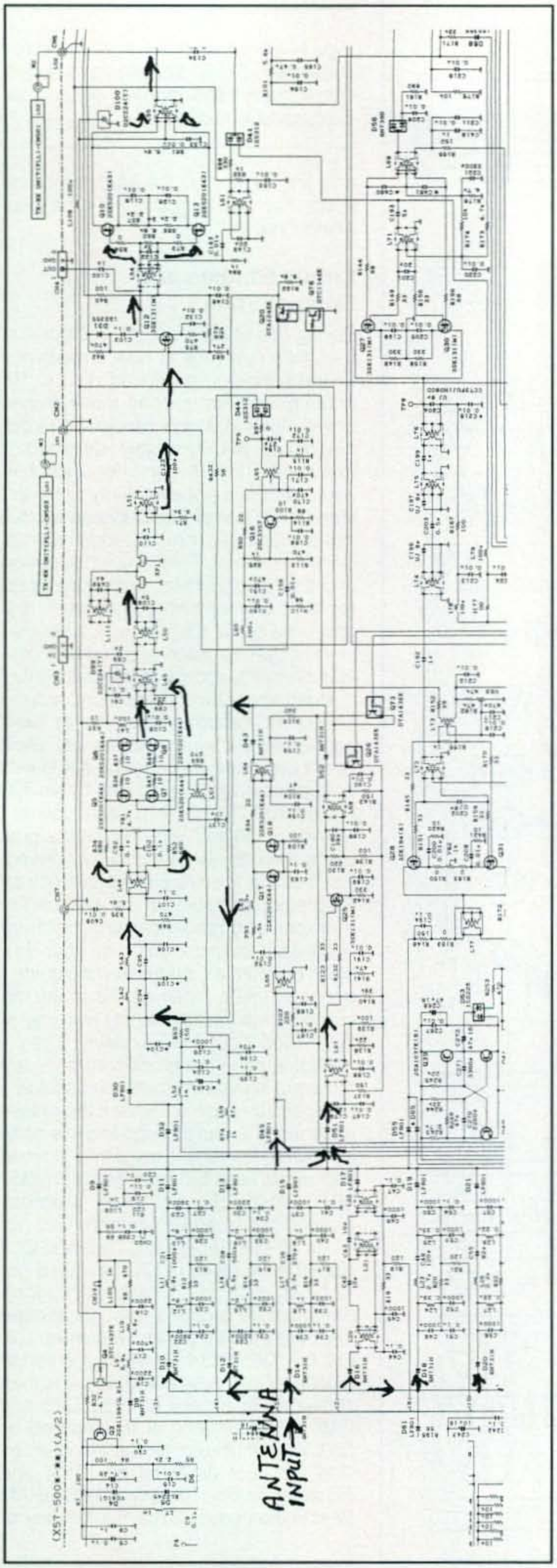
amp switch, turn on the attenuator, and notice how the buckshotting clears up. Interesting, eh?

Circuit Studies and Comparisons

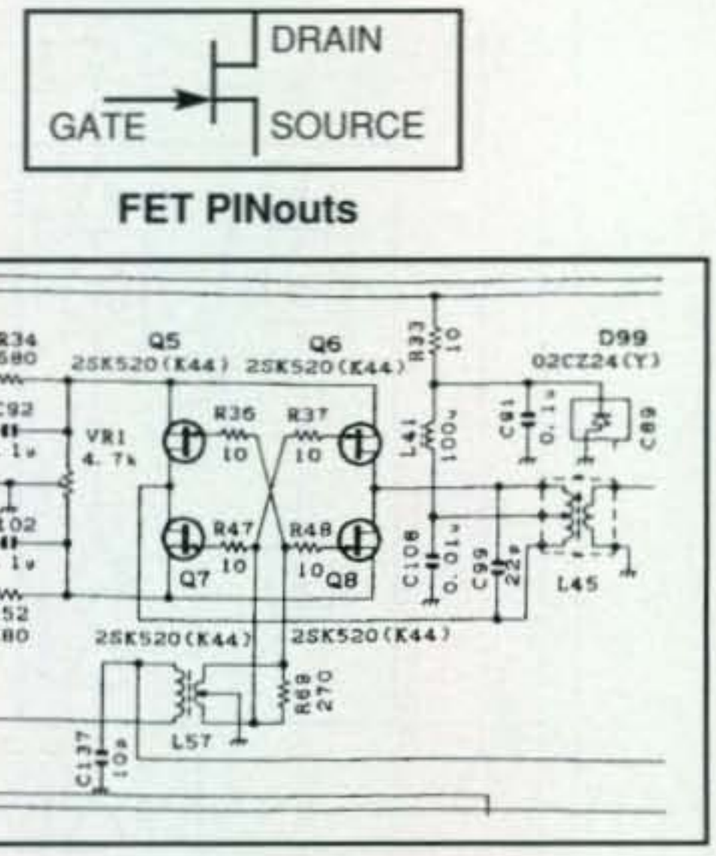
Taking this study a couple of steps further, let's now look at how a receiver's or transceiver's "front end" filters, RF preamp, and first/second mixer stages usually look in a rig's block and circuit diagrams. We randomly selected a Kenwood TS-570 for this example, because it is a popular "easy to understand" transceiver and because two full circuit diagrams are included with its owner's manual. Follow our discussion and then apply similar signal-path tracing logic to your own transceiver's diagram. If a circuit diagram is not included in your own transceiver's manual, contact the manufacturer to purchase one.

Most transceivers are built around several PC-board subassemblies interconnected via wiring harnesses. Their circuit diagrams are usually marked with dotted lines and labeled with "main TX-RX board," "PLL," "logic and control," "power amplifier," etc. Tracing signal paths through various circuits (indeed, just locating specific circuits such as an RF preamp or first mixer) on a circuit diagram can be quite challenging, but there is an easy solution. Just use your rig's block diagram as a "familiarizing guide," and then relate those details to the circuit diagram. Follow along with me in figs. 1 and 2 and I will explain.

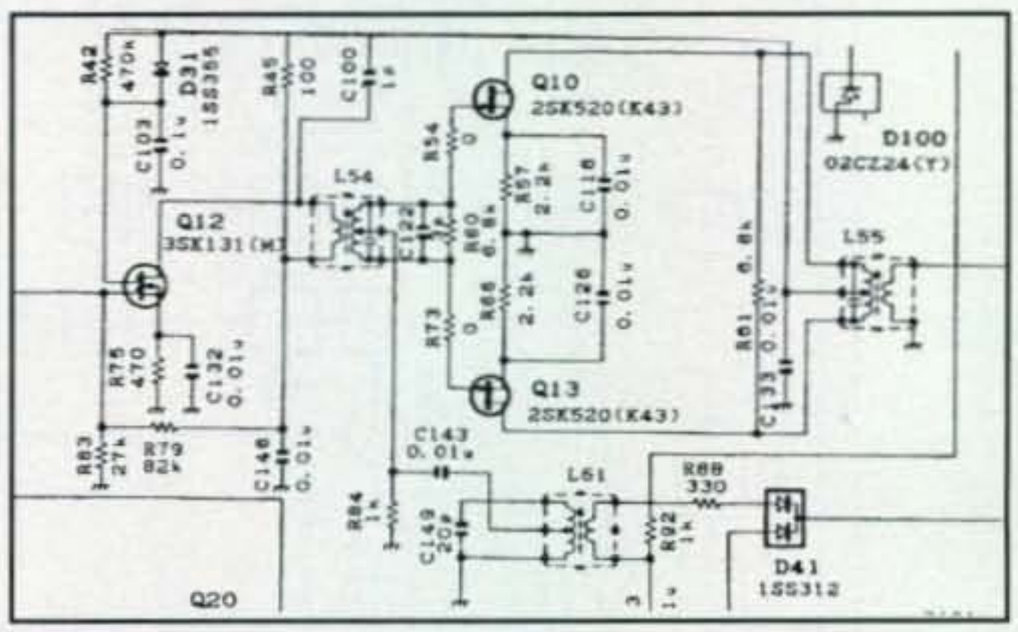
Beginning in the block diagram's left top area, signals from antenna socket 1 or 2 pass through or bypass the antenna tuner, proceed through two low-pass (–60 MHz) filters, and are diode-steered through a selected ham band (1.705–49.0) filter. Signals then progress through or around RF preamps Q25 (for 21- to 30-MHz reception), Q32, and Q33 (for 49 to 54 MHz) or Q17 and Q18 (for –21, or 1.7- to 21-MHz reception). Signals then proceed through another low-pass (–60 MHz) filter; first mixer Q5, Q6, Q7, Q8; a 73-MHz filter; and first IF amplifier Q12. A selected signal is then converted to a second IF by Q10 and Q13, RF attenuated or IF amplified by Q11, crystal filtered, further amplified by Q14, product detected by IC15; and resultant audio (at the CW/SSB/AM switch) then goes off the "TX-RX board"



← *Fig. 2– Circuit diagram of the main TX-RX board of a Kenwood TS-570 cropped down to the primary circuits/areas of study in this month's column and enlarged for viewing with a low-power hand magnifier. (Discussion in text.)* ↓



INSET A: Double Balanced First Mixer



INSET B: Balanced Second Mixer

for DSP tailoring, returns to the board for audio amplification by IC8, and routes to the speaker.

Now let's apply this acquired insight to the transceiver's circuit diagram, which we necessarily cropped down to "front end" circuitry so it will fit into magazine space (and also appear less complex than the full diagram); see fig. 2. Where to start? Look on the left for the antenna input wire and a group of bandpass filters. Follow the path to RF preamps Q25, Q17, and Q18. Use the related device numbers (such as 2SK520 for Q17 and Q18) to ensure you are on the right track. Follow the signal path through one of the bandpass filters, then on through D45 and L66, through preamps Q17 and Q18, L64, L44, and on to the inputs/sources of first mixer Q5, Q6, Q7, and Q8. Follow the mixer's output through L45, the 73.05-MHz filter XF1, and on to the input gate of IF amplifier Q12. Proceed on through L54 to the input gates of second mixer Q10 and Q13, and out via L55. Since we are only focusing on RF amplifying sections this month, our cropped circuit diagram ends at that point.

Now look carefully at *first IF amplifier Q12* (which is also enlarged for easier viewing in inset B). Notice the input signal (from L51) comes in to its gate and goes out (from its drain) to L54. This is a conventional single-ended configuration well known for its simple design and good signal gain (it

is sort of a "standard for reference"). Compare it to *RF preamp Q17 and Q18,* which is two FETs in parallel (incoming signals go directly to both gates; output signals from both drains go directly to L64). Properly biased, this somewhat less-popular configuration exhibits good, strong signal-handling capabilities. Both single-ended and parallel-configured circuits work well (not great) in RF and IF amplifier applications.

Next look at *first mixer Q5, Q6, Q7, and Q8* (expanded in inset A for easier viewing). Notice how out-of-phase signals from the top and bottom of L44 go to each FET's source, and outputs from each FET's drain route to top and bottom connections on L45. This is what equipment brochures refer to as a *double-balanced circuit.* Compare it with the regular balanced circuit arrangement in *second mixer Q10 and Q13,* where out-of-phase signals from the top and bottom of L54 go to gates, and outputs from drains go to the top and bottom of L55 (inset B). A balanced circuit, in my opinion, delivers better overall performance with better dynamic range and better noise immunity than a single-ended circuit (a parallel-wired circuit is also considered single ended; it is like one device with twice the surface area). A double-balanced circuit—again, in my opinion (but also supported by manufacturers and equipment brochures)—exhibits even better overall performance, better dynamic range, and better noise immunity than a regular balanced circuit. Its performance is what you might call "really superb," and that is quite an accomplishment for a mixer (which is by nature nonlinear and noisy).

Now continue studying RF amplifier and mixer stages in "front ends" of various makes and models of transceivers. Notice which ones have single-ended, balanced, and double-balanced circuits and note how they perform. Also go back and re-read this column's latter half while again tracing signal paths for full understanding. With a bit of time, practice, and study you will be able to accurately analyze a transceiver's performance by its circuit diagram—and that knowledge is well worth its pursuit.

Conclusion

Once again we have filled allocated space and must quickly "bow out" (time seems to go extra-fast when studying rigs and their circuits). Stay with us, however, as our travels through transceivers continue next time with a closer look at IF amplifiers, crystal filters, mechanical filters, and DSP (digital signal processing). Remember, too, you deserve some good on-the-air time every day. Go for it!

73, Dave, K4TWJ

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450 Ladder Line	#14 stranded conductors, poly, 390 Ω	34¢/29¢
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BY FREDERICK O. MAIA,* W5YI

Reflecting on the Year Past . . . and the Year Ahead

I am writing this column on the last day of 2004. Every year at about this time I pause to reflect on the events that impacted ham radio during the year . . . and look ahead to what might be in store for amateur radio in the coming year.

There were three big stories in 2004. One was a Notice of Proposed Rulemaking the FCC released in April that acted favorably on a 2002 ARRL petition to redistribute some Novice spectrum to General, Advanced, and Amateur Extra class licensees. The purpose of the petition was to reduce congestion in the HF phone bands. The second was a group of three proposals for a new entry-level ham class that would include HF phone operation. The third was the adoption of a Report and Order facilitating BPL (Broadband over Power Lines), a technology that uses household AC power to distribute the internet.

Code-Free Voice Operation for Beginners

Last year started out with the American Radio Relay League deciding at its January annual meeting to propose a new-entry level amateur radio license with code-free HF voice access. The League also voted to ask the FCC to consolidate all current licensees into three classes, retaining 5 words-per-minute Morse code testing only for the highest (Amateur Extra) class.

The ARRL's plan was in response to changes made in the section of the international Radio Regulations that governs amateur radio at the World Radiocommunication Conference 2003. WRC-03's most publicized change was that effective July 5, 2003, it would be optional for a country's amateur radio operators to demonstrate Morse code proficiency when operating HF. The ARRL proposal also continues the process of streamlining the amateur licensing structure that went into effect April 15, 2000.

The League was not the only organization to request that the FCC establish a new beginning license class. There were two others, and all three petitions were filed within a 30-day period in February and March of 2004.

ARRL's Entry-Level License Proposal

The League's proposal for a new entry-level ham license (RM-10867) was filed on March 18, 2004. The new beginning class, which the League wanted to be called Novice ("...at least for now," it said), would offer limited HF CW/data and phone/image privileges on the 80-, 40-, 15-, and 10-meter bands plus all VHF/UHF privileges between 6 meters and 70 cm (450 MHz). There would be no entry-level access to the 160-, 60-, 30-, 20-, 17-, or 12-meter bands.

The entry-level ("New" Novice) frequencies were changed somewhat from the ARRL's Novice spectrum "refarming" plan (RM-10413) filed two years earlier, on March 22, 2002. We show the "New" Novice bands requested by the ARRL in Table I and have indicated them with an asterisk.

The suggested transmitter power level was 100 watts on bands below 24 MHz and 50 watts above 24 MHz. The ARRL wants callsigns for the new Novice to continue to come from Group D—that is, two prefix letters, a district numeral, and three suffix letters.

The League restructuring plan would also consolidate Technician, Tech Plus (Technician with Element 1 credit), and General licensees into a new General license that no longer would *require a* Morse examination. Current Technicians automatically would gain General privileges without additional testing. Advanced class operators would automatically be upgraded to Extra. Applicants for Amateur Extra would still have to pass a 5-wpm Morse code examination, but the General and Extra written exams would stay the same.

NCVEC Entry-Level License Proposal

The National Conference of Volunteer Examiner Coordinators (NCVEC) is an umbrella group that consists of the 14 organizations that have been empowered by the FCC to develop and conduct amateur radio license testing. The NCVEC filed a Petition for Rulemaking (assigned RM-10787) right after WRC-03 closed, requesting that all Morse code testing be discontinued.

On March 1, 2004, the NCVEC followed this request with another Petition for Rulemaking (assigned RM-10870) proposing that the FCC reestablish an entry-level license "...with enough privileges so that a new licensee can experience a reasonable cross section of all that amateur radio has to offer." The new entry-level class, to be called the "Communicator" class, would require passing a simple 20-question multiple-choice written exam. Although the ARRL wanted a 25-question exam, the NCVEC petition was very similar to that filed by the ARRL.

The "Communicator" class name goes back to 1990, when the FCC proposed to offer a new code-free class of amateur operator license to "...encourage more young people to enter the Amateur Radio Service." It was not adopted. Instead the Morse code requirement was abolished from the Technician class and the codeless Tech was born.

The NCVEC's petition would upgrade all current Novices to the Communicator class. Like the ARRL proposal, all existing Technician and Tech Plus (Technician with Element 1 credit) licensees would be merged into to General and all Advanced class licensees to Amateur Extra without further testing. Once the Morse requirement goes away, NCVEC said in its filing, "...there will be no effective difference between the Technician and General class licenses."

The new Communicator ticket would permit a power limit of 100 watts on bands below 24 MHz

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Proposed Realignment of Amateur Service HF Subbands

Band	Class	Current Band	FCC Proposed	Increase
80 m Phone	Extra	3750–4000 kHz	3725–4000 kHz	+25 kHz
	Advanced	3775–4000 kHz	3750–4000 kHz	+25 kHz
	General	3850–4000 kHz	3800–4000 kHz	+50 kHz
	Novice*	None	3900–4000 kHz	+100 kHz*
80 m CW/Data	Extra	3500–3750 kHz	3500–3725 kHz	–25 kHz
	Advanced	3525–3750 kHz	3525–3725 kHz	–25 kHz
	General	3525–3750 kHz	3525–3725 kHz	–25 kHz
	Nov-Tech+	3675–3725 kHz	3525–3725 kHz	+150 kHz
	Novice*	3675–3725 kHz	3550–3700 kHz*	+100 kHz*
40 m Phone	Extra	7150–7300 kHz	7125–7300 kHz	+25 kHz
	Advanced	7150–7300 kHz	7125–7300 kHz	+25 kHz
	General	7225–7300 kHz	7175–7300 kHz	+50 kHz
	Novice*	None	7200–7300 kHz*	+100 kHz*
40 m CW/Data	Extra	7000–7150 kHz	7000–7125 kHz	–25 kHz
	Advanced	7025–7150 kHz	7025–7125 kHz	–25 kHz
	General	7025–7150 kHz	7025–7125 kHz	–25 kHz
	Nov-Tech+	7100–7150 kHz	7025–7125 kHz	+50 kHz
	Novice*	7100–7150 kHz*	7050–7125 kHz*	+25 kHz*
15 m Phone	Extra	21200–21450 kHz	21200–21450 kHz	None
	Advanced	21225–21450 kHz	21225–21450 kHz	None
	General	21300–21450 kHz	21275–21450 kHz	+25 kHz
	Novice*	None	21350–21450 kHz*	+100 kHz*
15 m CW/Data	Extra	2100–21200 kHz	2100–21200 kHz	None
	Advanced	21025–21200 kHz	21025–21200 kHz	None
	General	21025–21200 kHz	21025–21200 kHz	None
	Nov-Tech+	21100–21200 kHz	21025–21200 kHz	+75 kHz
	Novice*	21200–21200 kHz	21050–21200 kHz	+50 kHz*
10 m Phone	Extra	28300–29700 kHz	28300–29700 kHz	None
	Advanced	28300–29700 kHz	28300–29700 kHz	None
	General	28300–29700 kHz	28300–29700 kHz	None
	Nov-Tech+	28300–28500 kHz	28300–28500 kHz	None
	Novice*	28300–28500 kHz	28300–28500 kHz	None
10 m CW/Data	Extra	28000–28300 kHz	28000–28300 kHz	None
	Advanced	28000–28300 kHz	28000–28300 kHz	None
	General	28000–28300 kHz	28000–28300 kHz	None
	Nov-Tech+	28100–28300 kHz	28000–28300 kHz	+100 kHz
	Novice*	28100–28300 kHz	28050–28300 kHz*	+50 kHz

Table I– The above chart reflects the changes in the HF bands as requested by the ARRL in their 2002 "refarming" petition (RM-10413) and proposed by the FCC in an NPRM (WT Docket No. 04-140) released April 15, 2004. On March 18, 2004, the ARRL again petitioned the FCC, requesting that the Technician and Advanced classes be abolished and these licensees be upgraded to the next higher class without examination. No changes were suggested over those proposed in RM-10413 for the General and Extra class. The ARRL suggested major changes, however, to the "new" entry-level Novice class. These are indicated in the above chart with an asterisk (*).

and 50 watts on all frequencies above 24 MHz, the same as proposed by the ARRL. A difference, however, is that Communicator licensees would be required to use commercially manufactured equipment or gear built from a commercial kit. The reason for this is twofold. First, a short 20-question written exam cannot adequately test applicants on construction techniques. Second, it would eliminate the need for many technical questions.

Communicators would operate both voice and digital modes on 80, 40, 15 and 10 meters plus VHF and UHF up to 70 cm. The frequencies are somewhat similar (but not exactly the same) to those proposed by the ARRL. Due to propagation characteristics, the NCVEC placed more emphasis on the 15- and 10-meter bands. Also suggested was the possibility of assigning the currently unallocated NA1 through NZØ by three-letter callsign block to new entry-level licensees.

RAF Entry-Level License Proposal

A third petition (designated RM-10868) was filed with the FCC by an obscure "unincorporated grassroots organiza-

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tion" calling itself the Radio Amateur Foundation (RAF). No one seems to know who they are.

The RAF wants the FCC to modify the Technician ticket to allow restricted HF phone, data, image, and CW privileges. The group also proposes retaining the 5 words-per-minute Morse requirement for General and Amateur Extra applicants, and upgrading Advanced class holders to Extra and all Novices to Technician. It said it sees no need to change licensing requirements for General or Amateur Extra applicants.

The RAF also wants to abolish the existing amateur radio question pools and start over. The new pools would be kept secret and out of the public domain. A ten-day waiting period would be necessary before an applicant could be retested. In addition, RAF would permit only Generals and Amateur Extras or Technicians licensed more than two years to request vanity callsigns.

The RAF has further asked the FCC to permit digital experimentation from 29.0 to 29.3 MHz at bandwidths of up to 15 kHz.

On March 24, 2004, the FCC accepted the three new entry-level petitions for public comment. It is expected that sometime during 2005 the FCC will be issuing a Notice of Proposed Rulemaking looking toward implementing a new entry-level ham ticket that includes HF phone privileges.

Other WRC-03 Petitions

In addition to petitions asking that a new entry level be established, the FCC has on hand more than a dozen other petitions that were filed after WRC 2003 closed. An FCC staffer told us that these requests will be considered by the Commission as part of the proceeding dealing with a new entry-level license.

These petitions primarily address Morse code issues in the Amateur Radio Service. Some petitioners want all code testing abolished, while others request only partial removal. One petitioner wants all code testing retained permanently. Still another wants separate voice and code testing, with the applicant only being tested on code if CW operation is intended.

Several petitioners ask that Technician class licensees be authorized the same 10-meter voice privileges that are available to Novice and Tech Plus licensees. One wants to prohibit re-testing of examinees at the same session; another wants only two operator license classes—General and Extra—with only the Extra class being required to take a code test.

Omnibus Amateur Radio NPRM Released

On April 15, 2004, the FCC released a Notice of Proposed Rulemaking (WT Docket No. 04-140) that proposed many wide-ranging changes to the Amateur Radio Service rules. The NPRM primarily addressed old petitions.

Perhaps the most significant feature of the NPRM is that the FCC recommended adopting the ARRL's 2002 "Novice refarming" plan, which proposed to redistribute Novice spectrum to other classes . . . primarily to relieve spectrum congestion in the voice subbands.

The FCC said that because the League's petition addresses the operating privileges of all license classes "...we believe that the ARRL petition provides a basis for a comprehensive restructuring of operating privileges." See Table I for the FCC's proposed new HF phone/CW sub-bands. Basically, the FCC proposed the frequency changes that the ARRL asked for in RM-10413. Thus, radio amateurs can expect new voice spectrum for the higher license classes to be added in 2005.

The FCC also proposed eliminating its rules prohibiting manufacture or marketing of Amateur Service power amplifiers capable of operating between 24 and 35 MHz. Originally adopted 25 years ago to keep high-powered amateur amplifiers off of the 11-meter CB band, the FCC is now relenting and says these rules "...impose unnecessary restrictions on manufacturers of amateur radio equipment and are inconsistent with the experimental nature of the Amateur Service."

The FCC additionally proposed to make Kenwood's Sky Command system legal for operation within the U.S. The proposed rules would permit auxiliary operation on 2 meters above 144.5 MHz with the exception of the satellite subband at 145.8 to 146.0 MHz. The Sky Command system permits the user to operate certain Kenwood equipment remotely via a VHF/ UHF handheld transceiver.

In response to an ARRL petition, the FCC proposed extending the bands available for spread-spectrum experimentation and use to include 222–225 MHz and, although not requested, include the 6- and 2-meter bands as well. Current rules limit SS emissions to frequencies above the 70-cm band.

To curb the unfair practice of gaining an advantage in the assignment of Vanity callsigns, the FCC will prohibit more than one application per applicant being filed for a vanity callsign. It also proposes to permit the retransmission of communications between a manned spacecraft and its associated Earth stations, including the International Space Station; allow current amateurs to designate a specific amateur radio club to acquire their callsign in memoriam; eliminate the requirement that a public announcement be given of volunteer examiner test locations and times; and provide Element 1 (5-wpm Morse) credit to any applicant who holds a Technician license granted after February 14, 1991 and who can document having passed a telegraphy examination element.

The Commission also made some "housekeeping" changes in Part 97. It ordered that the definition of an "amateur operator" be amended to reflect that a listing in the FCC's Universal Licensing System (ULS) database, and not a license document, determines whether a person is a licensed amateur radio operator. This more or less makes a license document unnecessary.

Saying the band plan was adequate, the FCC denied a petition that would have established separate CW and phone sub-bands on 160 meters. Several other petitions were turned down, including one that would have imposed restrictions on the time, length, or transmission frequencies of transmitted information bulletins . . . and another ARRL request for a special-event callsign system for territories and posses-

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sions that have no specified mailing addresses. The FCC suggested using self-assigned indicators instead.

Broadband Over Power Lines (BPL)

BPL is a technology that seeks to use AC power wiring to distribute the high speed internet in a residential environment. You simply plug a small power-line modem into a normal wall outlet and the house electrical wiring provides the inside connections between computers. To get the internet into your home, radio energy is coupled onto power lines and modulated by a utility company.

BPL is being touted as another residential broadband technology similar to DSL and cable modems, especially for rural homes where deployment costs are prohibitive. A major perceived advantage of BPL is that since electrical wiring is everywhere, expensive cables or fiber would not have to be run. Power utility companies also see it as a way to get additional revenue. If it works without interference, the economic potential could be huge. But it doesn't.

The bottom line is that AC wiring is not designed to carry radio signals, and it has been clearly demonstrated in technical studies that power lines act like antennas. Interference is the result. The fear is that licensed users of the spectrum will be waging war with their unlicensed internet-using neighbors, and vice versa, if an amateur's signals disrupt the internet next door.

Cable companies use frequencies in VHF and UHF bands that can wreak havoc to nearby frequencies when they leak out. The signals therefore are required to be contained within a shielded coaxial cable. No such requirement exists with BPL. In this columnist's view *(and the magazine's as well—ed.)*, it simply makes no sense to inject HF radio frequencies into unshielded wire, especially in a residential environment.

On April 23, 2003, the Commission launched a Notice of Inquiry (ET Docket No. 03-104) to gather information and technical data on Broadband over Power Lines. It is important to understand that no additional rules or permission was required to allow BPL to operate under existing unlicensed Part 15 FCC rules. However, the technology had never been widely deployed, and that was something that power companies wanted to change.

Despite overwhelming public opposition, on March 24, 2004 the FCC issued a Notice of Proposed Rulemaking (ET 04-37) "...facilitating the deployment of Access BPL technology while protecting licensed users of the spectrum." The NPRM also proposed procedures to "mitigate" (reduce) interference. Public comments closed on June 22, 2004.

The NPRM did reaffirm the important principle that licensed services must be protected from harmful interference and are not required to protect BPL systems. Hopefully, the FCC will enforce this principle, but will your neighbors understand?

The FCC also proposed that BPL providers employ "adaptive interference mitigation techniques" and maintain a public database of installation locations and technical information to assist in locating BPL system operators.

Less than four months later (on October 14, 2004) the FCC adopted a Report & Order essentially following its proposed rules. BPL operators will be required to address and resolve all valid interference complaints. It declined, however, to reduce the Part 15 radiated emission limit for BPL systems, stating that emissions from BPL systems are localized and power levels are low enough to preclude harmful interference. The Commission favors "notching," frequency shifting, power reduction, and even shutdown by BPL systems as the preferred mitigation methods.

Notching out certain frequencies—as a way to reduce interference—does not seem to be the answer. BPL signals propagate for very long distances due to the HF frequencies being used, and it is very difficult to track down the source of BPL interference. It could be many miles, even hundreds of miles, away!

Furthermore, notching works only where there is significant open space in the HF spectrum. There isn't any. Anywhere you look, there's a radio service using the frequency. Also, BPL systems add to the noise floor, making it increasingly difficult to receive weak signals. As a result, ham operators across the board are opposing the technology. Even Japan declined to adopt BPL due to its interference potential.

Utility companies with deep pockets continue to promote BPL, and many test systems are under way or are on the drawing board. You can expect that as more BPL systems are deployed during 2005, you will be hearing a lot about interference from Broadband over Power Lines. The ARRL continues to believe that BPL signals have the potential to "...transform HF from a quiet haven that hams enjoy to a noisy industry wasteland, changing ham radio forever."

73, Fred, W5YI

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BY JOE LYNCH,* N6CL

New 122-GHz Distance Record

In mid-January, as this is being written, Brian Justin, WA1ZMS/4, and Pete Lascell, W4WWQ, reported what should be a new World and North American DX record for the 122-GHz band. (This band was "new" in the US. as of March 2004, and WØEOM reported the first QSO on the band several months ago.) In addition, they reported completing the required number of contacts for the first ARRL VUCC Award for that band.

Using the club callsign W2SZ/4 from a fixed location in FM07fm, they managed to work the required five grids (FM06, FM07, FM08, EM96, EM97) for the VUCC Award. The first grid was worked on January 9, while the final four were worked in a "grid-square blitz" over a 10-hour period on January 16.

Their best DX was on January 16 at 0422 UTC, when WA1ZMS/4 at N36-59-28, W80-07-17, and grid EM96wx worked W2SZ/4 (W4WWQ op.) at N37-31-00, W79-30-35, and grid FM07fm. The distance was 79.6 km. The weather at WA1ZMS was as follows: temperature –2.6° C, dew point –10° C, relative humidity 58%, and pressure 937 mb, resulting in an atmospheric loss: of 0.472 dB/km.

The equipment used was a 12-inch parabolic with Cassegrain feed, TX power 5 mw at the feed. The rigs were phase-locked 61-GHz Gunn sources driving a pair of GaAs frequency doublers. The doublers served as harmonic mixers for receive with active DC bias control. Frequency references were Wenzel ultra-low-noise 5-MHz crystal oscillators. More details on these QSOs have been posted at <http://www.mgef.org/zms_122_VUCC.htm>. *(The above information courtesy of Buck Rogers, K4ABT.)*

Tulsa ARISS QSO

After more than 150 educational QSOs with the space shuttle and the International Space Station, it was finally Tulsa, Oklahoma's turn. Taking more than two years and one delay to come together, on December 22, 2004 nine students had the opportunity to ask ISS commander Leroy Chiao, KE5BRW, 18 questions during the 9-minute window.

The host amateur radio club was the Tulsa Repeater Organization (TRO), and the venue for this 157th ARISS QSO was the Tulsa Air and Space Museum (TASM). Located in one of the early hangars used by the Tulsa International Airport, the museum houses numerous displays related to the history of aviation in Oklahoma. It was in front of an old NASA console that a new, modern ham radio station was set up for the contact.

Promptly at 9:12 AM (1512 UTC) contact was established with the ISS and students began their litany of questions for Commander Chiao. For the list of questions, please see the sidebar. The students who participated were William Bloomfield, from Thoreau Demonstration Academy, Tulsa;

e-mail: <n6cl@sbcglobal.net>

VHF Plus Calendar

Mar. 3	Last Quarter Moon
Mar. 6	Very Poor EME conditions
Mar. 8	Moon Perigee
Mar. 10	New Moon
Mar. 13	Moderate EME conditions
Mar. 17	First Quarter Moon
Mar. 19	Moon Apogee
Mar. 20	Vernal Equinox. Moderate EME conditions
Mar. 25	Full Moon
Mar. 27	Moderate EME conditions

—EME conditions courtesy W5LUU.

Chase Kamstadt, from Austin, Texas, asks one of his two questions of ISS Commander Leroy Chiao, KE5BRW, while Bill Griffin, NI5X, controls the earth station for the Tulsa Air and Space Museum ARISS QSO. (N6CL photo)

Kyler Swearingen, from Marquette Private School, Tulsa, and Robert Nolan, from Foster Middle School, Tulsa (along with all of the other student participants) received certificates from Tulsa Repeater Organization president Mark Conklin, N7XYO, for their participation in the TASM ARISS QSO. (N6CL photo)

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Wyatt Bonicelli, from Pratt Elementary, Sand Springs, Oklahoma; Ryan Darrow, from Holland Hall, Tulsa; Chelsie Downie, from Emerson Elementary, Tulsa; Lawrence Ross, from Victory Christian, Tulsa; Chase Karnstadt, from Austin, Texas; Robert Nolan, from Foster Middle School, Tulsa; Lauren Olten, from North Intermediate High School, Broken Arrow, Oklahoma; and Kyler Swearingen, from Marquette Private School, Tulsa.

Questions were developed as a class project at Thoreau Demonstration Academy. In addition to the 18 questions the students asked, Katheryn Pennington, the museum's executive director, asked a question, and at the end of the QSO season's greetings were passed on to the ISS crew. Altogether there were 20 questions scheduled to be asked, but due to a last-minute absence of one of the students scheduled to participate, his two questions were omitted.

Others observing the contact were the parents of the students participating in the contact, and four students and their advisor from Hamilton Middle School: Shanekah Jones, Leo Alexander, Quiara Scott, Shayla Bethel, and Ms. Rita Balleu. Also present were representatives from three of the local television stations, the local newspaper, and your editor, representing *CQ* and *CQ VHF* magazines.

Mentoring this contact was Keith Pugh, W5IU, *CQ VHF* magazine's satellites columnist. Handling the radio was Bill Griffin, NI5X. Along with Griffin was the president of TRO, Mark Conklin, N7XYO. Also working to make the contact a success were TRO members Ed Compos, K5CRQ, and Harry Mueller, KC5TRB. TRO's website is <http://www. TulsaHamRadio.com>.

Preparations for the ARISS QSO started with an application made to the ARISS Program via the ARRL more than two years ago. The contact initially was scheduled for June 2004. However, a high-priority "Space Walk (EVA)" came up at almost the last minute and caused a re-scheduling for the week of December 20. Final preparations resumed in November 2004, leading up to the contact. No equipment was available at TASM to support the contact at the museum, so TRO and others provided equipment for the contact.

Two complete stations were assembled. The primary station consisted of a Hy-Gain circularly polarized Yagi, an Advanced Receiver Research (ARR) RF switched GasFet pre-amp, Yaesu G-5500 Az-El rotators on a portable tower driven by a Yaesu FT-847 transceiver, LabJack/ LabJack Piggyback Rotator Interface, and Nova tracking software. Tulsa's Mobile Equipment International loaned a 40-foot communications tower to TASM for the antennas.

Doppler correction of both the uplink and downlink was done in the FT-847 by storing multiple frequency pairs in memories and selecting these appropriately. This may seem like "overkill" to work the ISS, but it is necessary to maximize the contact time. Every effort was made to construct a station capable of communicating with the ISS from "horizon to horizon."

To take care of "Murphy," a secondary station was assembled. This station was not capable of "horizon to horizon" contacts. It consisted of a simple vertical antenna, an FT-897 transceiver, tracking software, and battery power. While not as capable as the primary station, the secondary station was very simple and not as dependent on technology.

All of the equipment was brought together, assembled, and checked out the day before the contact. Students were briefed ahead of time on the procedures to be followed during the contact. "Dry runs" with the students were not possible due to the varied Space Camp backgrounds of the students. "Dress rehearsals" were accomplished just before the contact on the morning of the event. Everything went well during the contact, and the secondary sta-

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TASM Questions Asked of Commander Chiao

1. Lawrence: Do the G-forces from leaving the Earth's atmosphere cause you to have little red spots on your face that we kids call G-measles?
2. William: How much of the International Space Station is complete and what is the expected life (of the station)?
3. Chelsie: What does one day in the space station look like?
4. Chase: Is it hot or cold up there?
5. Ryan: What do you think the benefits are of civilian space travel? Do you foresee civilians ever visiting the ISS?
6. Kyler: Has any space junk or meteor pieces ever hit the space station?
7. Robert: How is the physical training different at NASA than from the military?
8. Lauren: What would your advice be for an aspiring astronaut?
9. Wyatt: Can you see storms that happen on Earth?
10. Lawrence: Do you have to use parachutes to slow down after going through the Earth's atmosphere to land?
11. Ryan: What is the physical impact of a zero-gravity environment on you over a long period of time and how do you deal with this when you return to Earth?
12. William: What is the scariest or most dangerous thing that you do?
13. Lauren: Is it worth all the time, effort, et cetera, to become an astronaut?
14. Robert: What is it like working with someone from another country for a long time?
15. Chelsie: What kind of foods do you like to eat in space?
16. Chase: What do you do for exercise?
17. Kyler: What has been the most interesting experiment you have gotten to work on in the station?
18. Wyatt: Is it fun floating and how does it make your body feel?

Ms. Pennington asked: As you are looking out the space station right now, what do you see?

tion was not utilized. During the QSO, at times the signal from the ISS pegged the S-meter on the Earth station.

All of the efforts were rewarded by the smiles on the faces of the students, parents, and other observers. It is likely that a seed was planted in at least one or two students to pursue a career in the sciences or engineering, and who knows? One of them may fly as an astronaut in the future. For more information on your school or organization supporting an ARISS QSO, please visit the AMSAT website at <http://www.amsat.org/amsat/ariss/news/arissnews.txt>. Also, please see "How Kids Can Talk To Space People" by Gene Chapline, K5YFL, which appeared in the Winter 2003 issue of *CQ VHF* magazine.

In commenting on the ARISS QSO, TASM's executive director, Katheryn Pennington, said, "Statistics prove learning and retaining knowledge improve for children when they are personally involved. The radio linkup will broaden their horizons, giving them a new perspective of space living and exploration. Teachers can expand this experience by relating it to science, geography, history, and physics. Children can explore the relationship of life on Earth and how it compares to life in space."

TASM annually holds a summer camp that instills self-confidence and self-reliance in young students by exposing them to traditional and non-traditional fields of work through supporting their interest in math, science, and technology. Students chosen to participate in this ARISS contact had previously attended one of TASM's summer camps. For more information on the mission of TASM, visit <http://www.tulsaairandspacemuseum.com>.

It seems that ham radio also has had an effect at TASM. Apparently, the ham radio bug has bitten at least one member of the staff. The museum is scheduled to move to a new 25,000-square-foot facility late this summer. In a subsequent conversation your editor had with Kim Jones, the museum's curator, he indicated to me that he plans on allocating space for a permanent amateur radio station.

Contributing to this story was Keith Pugh, W5IU. Portions of this story also appear in the Winter 2005 issue of *CQ VHF* magazine under Keith's authorship in the article entitled "Patience Pays Off."

GPS May be Shut Down in the Event of Terror Attack

For those of us who use GPS (global positioning system) for our hobby—such as rover operations)—it is important to note that according to a December 15, 2004 Associated Press report, President Bush has ordered plans for the temporary disabling of portions of the U.S. GPS system should the U.S. come under attack by terrorists. The AP report stated in part:

> Any shutdown of the network inside the United States would come under only the most remarkable circumstances, said a Bush administration official who spoke to a small group of reporters at the White House on condition of anonymity.
>
> The President also instructed the Defense Department to develop plans to disable, in certain areas, an enemy's access to the U.S. navigational satellites and to similar systems

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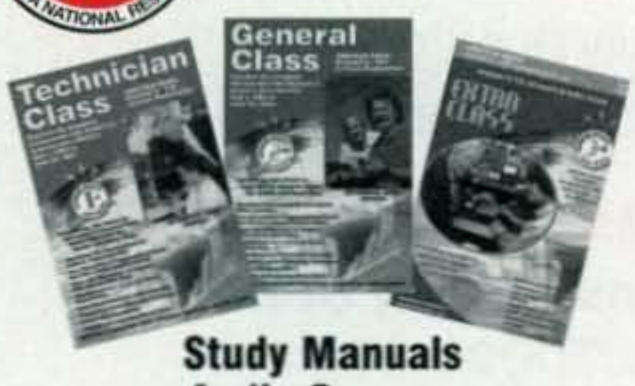

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operated by others. The European Union is developing a $4.8 billion program, called Galileo.

President Clinton abandoned the practice in May 2000 of deliberately degrading the accuracy of civilian navigation signals, a technique known as 'selective availability.' The White House said it will not reinstate that practice, but said the president could decide to disable parts of the network for national security purposes.

The directives to the Defense Department and the Homeland Security Department were part of a space policy that Bush signed this month. It designates the GPS network as a critical infrastructure for the U.S. government. Part of the new policy is classified; other parts were disclosed Wednesday.

The White House said the policies were aimed at improving the stability and performance of the U.S. navigation system, which Bush pledged will continue to be made available for free.

For more information on this report, please search the World Wide Web, where there are numerous references to the AP story.

One Gigabyte-per-Second BPL Rates Possible?

According to a press release entitled "Power line data transmission capacity: Bigger than DSL or cable" dateline Thursday, January 6, 2005, which appeared on the Penn State University website (see <http://live.psu.edu/story/9603>), "Penn State engineers have developed a new model for high-speed broadband transmissions over U.S. overhead electric power lines and estimate that, at full data rate handling capacity, the lines can provide bit rates that far exceed DSL or cable over similar spans."

The press release goes on to discuss the pros and cons of the engineers' new model. Dr. Mohsen Kavehrad, the W. L. Weiss professor of electrical engineering and director of the Center for Information and Communications Technology Research, led the investigation of the model. The press release states that the researchers say they are the first to evaluate data-rate handling capacity for overhead medium-voltage unshielded U.S. electric power lines and that they outlined their findings at the IEEE Consumer Communications & Networking Conference in Las Vegas, Nevada, this past January 5. Authored by Pouyan Amirshahi, Kavehrad's doctoral student, and Kavehrad himself, their paper is entitled "Transmission Channel Model and Capacity of Overhead Multi-conductor Medium-Voltage Power-lines for Broadband Communications."

Commenting on present BPL trials, Kavehrad stated, "Although broadband power line (BPL) service trials are now under way on a limited basis in some locations in the U.S., these trials run at DSL—comparable rates of 2 or 3 megabits per second."

Kavehrad added, "We've run a computer simulation with our new power-line model and found that, under ideal conditions, the maximum achievable bit rate was close to a gigabit per second per kilometer on an overhead medium-voltage unshielded U.S. electric power line that has been properly conditioned through impedance matching. The gigabit can be shared by a half dozen homes in a neighborhood to provide rates in the hundreds of megabits per second range, much higher than DSL and even cable."

At first blush, it might seem that the idea of running broadband internet service at the rate of hundreds of megabits per second would be scary to those of us on the VHF+ bands due to the increased bandwidth required. However, we should not worry, thanks to what else the researchers discovered.

Kavehrad continues, "If you condition those power lines properly, they're an omni-present national treasure waiting to be tapped for broadband internet service delivery, especially in rural areas where cable or DSL is unavailable." What does he mean by conditioning the power lines?

Here is the caveat of their model: According to the press release, in their paper "the authors note that the junctions and branches in the U.S. overhead electrical grid cause broadband signals to reflect and produce multipath-like effects on these lines. This causes degradation in power-line broadband transmission performance and decreases transmission capacity." Your editor personally wants to thank these researchers for saying that their research has disclosed what the engineers at the ARRL have been saying all along concerning the radiation problems associated with using power lines.

Going back to Kavehrad, he explains, "The signal can bounce back and forth in the lines if there is no proper impedance matching. The bouncing takes energy away from the signal and the loss is reflected in the ultimate capacity." We know this effect as standing waves. Kavehrad correctly deduces that without proper impedance matching, power lines present infinite problems as related to radiation and standing waves for the RF that is being carried on them.

Kavehrad concludes, "In service, performance will depend on how close the power company chooses to place the repeaters." Does Kavehrad mean that these repeaters will also include SWR matching devices? If so, then the standing waves of each segment of the power line will have to be calculated and then a matching device will have to be designed specifically for that segment of the power line.

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The press release continues, "The researchers are continuing their studies. Kavehrad predicts that the engineering issues to make BPL a technical alternative to DSL and cable will be solved. Whether it will be an economical alternative remains to be seen, since there are interference issues that have to be overcome."

Frankly, while a computer model may solve the problems that the researchers have uncovered, in a practical sense, it is not likely that these problems will come anywhere near being solved. Finally, the press release concludes that there are doubts about the economic viability due to "interference issues that have to be overcome." Now there is a left-handed admission if I ever read one. In comparison with building all of those matching devices, interference issues will be the least economic problem facing BPL proponents. Perhaps, if the Penn State researchers were to take a walk across their campus to the business school, they might become convinced as to just how *uneconomical* BPL is as a potential source for broadband internet service.

At the end of the press release, it is disclosed that the study was supported by a grant from AT&T Corporation. This is the same AT&T Corporation that has now backed out of BPL research, indicating, according to the ARRL, that AT&T has decided to direct its business energies elsewhere. For more information on AT&T's decision, see "AT&T, Pacific Gas and Electric Dissolve BPL Partnership," which appears in the October 21, 2004 edition of the *ARRL Letter*. This reference can be found online at <http://www.arrl.org/news/stories/2004/10/21/100>.

Geomagnetic Storm Reported in mid-January

As this column is being written, Tomas Hood, NW7US, *CQ* magazine's "Propagation" columnist has been keeping the VHF reflector updated on a major solar storm. Please check out his column elsewhere in this issue for the details. If there is a significant increase in VHF aurora propagation, I will report on it in next month's column. For near real-time information on current propagation activity, see the NOAA alert website at: <http://www.sec.noaa.gov/alerts/index.html>.

Current Activities

Southeastern VHF Society: The society's ninth annual conference will be hosted in Charlotte, North Carolina on April 29 and 30. The location will be the Hilton Charlotte Executive Park, 5624 Westpark Drive, Charlotte, NC 28217 (phone 704-527-8000, fax 704-529-5963). Group rate is $75 per night. It is best to call the hotel directly, and be sure to mention the Southeastern VHF Society Conference to get the discount rate. For more information about the hotel see <http://www.hilton.com/en/hi/hotels/index.jhtml?ctyhocn=CLTEPHF>.

Registration for the conference was not available at press time. Please check the website <http://www.svhfs.org/registration_05.htm> for the registration forms.

Dayton HamVention®: The Dayton HamVention® will be held as usual at the Hara Arena in Dayton, Ohio, May 20–22. For more information, please see <http://www.hamvention.org>. Your editor is scheduled to be one of the speakers for the VHF forums.

Calls for Papers

Calls for papers are issued in advance of forthcoming conferences either for presenters to be speakers, or for papers to be published in the conferences' *Proceedings*, or both. For more information and questions about format, media, hardcopy, e-mail, etc., contact the person listed with the announce-

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ment. To date this year the following organizations or conference organizers have announced calls for papers for their forthcoming conferences:

The **Southeastern VHF Society** (see conference dates announcement above): Contact Ray Rector, WA4NJP. Ray's e-mail address is <wa4njp@bellsouth.net>. The deadline for submitting papers is as soon as possible.

The 39th annual **Central States VHF Society Conference** will be held July 28–31 at the Sheraton Hotel, Colorado Springs. Your editor has agreed to chair the technical forum at the conference. The deadline for submitting final papers will be around May 1, 2005. Submit your papers as soon as possible to your editor at this e-mail address: <n6cl@sbcglobal.net>.

Current Meteor Shower

The γ-*Normids* meteor shower is expected to peak on March 13 and again on March 17. This information courtesy the International Meteor Organization and its website: <http://www.imo.net>.

And Finally . . .

Four students representing Hamilton Middle School (Tulsa) were present at the Tulsa Air and Space Museum ARISS contact. This occurred as a result of your editor's relationship with the school. Two years ago, Sheridan Avenue United Methodist Church, the local congregation that I pastor, adopted the school, and an ongoing relationship with the school has continued. When Keith, W5IU, advised me of the ARISS event, with the permission of the school's principal, I contacted the students' teacher, Ms. Balleau. As a result of my contacting her, she was able to arrange to bring her students to be observers of the event, which occurred during their winter class break.

I tell this part of the story of the ARISS contact because Hamilton is an at-risk school within the Tulsa Public School system. I believe that it is the responsibility of the community surrounding such at-risk schools to become proactive and work with these schools' administrations and faculty in any way possible to expand the learning opportunities for the students. The ARISS event became one such way to do that.

Once again, amateur radio has made a positive impression on non-hams. Thanks to the ARISS contact, a door was opened at Hamilton. Hopefully, there will be future opportunities for amateur radio to be used to further the education of the students at this school.

Perhaps you are aware of such an at-risk school in your area that your ham club could adopt. While there is a lot of work involved in adopting a public school, the rewards far outweigh the work. In addition, you and your organization might find yourselves surrounded by other members of the community who will collaterally receive a good impression of amateur radio due to your efforts. Such has been the case with us.

Recently, after the two years that my congregation has been the sole adopter of Hamilton, a group of concerned citizens was formed to support Hamilton. This group is comprised of representatives of nearby elementary schools, a community college, and Tulsa Public Schools board members, as well as representatives of nearby businesses and TASM. At the first meeting following the ARISS event, I passed out copies of the then-forthcoming *CQ VHF* magazine article covering the ARISS event, while being sure to point out the picture of the Hamilton students and teacher. Quite obviously, the article gives excellent publicity for ham radio, as well as for Hamilton.

My public-relations effort has not ended with passing out the article. When I learned that TASM's curator had been invited to my congregation's monthly men's breakfast, I made sure to bring a copy of the article with me, as well as an excerpt of the videotape that I made of the event and a CD copy of all of the photos that I took. I showed the videotape as part of the presentation that morning, and then gave it, along with the article and CD, to the curator for his museum archives. It was during our subsequent conversation that morning that he told me of his plans to make space for a permanent ham radio station. Once again, ham radio evangelism just might pay off, because perhaps a long-term effect of the ham radio exposure at TASM will result in another conversion—that being the curator's conversion to the hobby of ham radio!

These are exciting times on the VHF+ ham bands, because a lot of innovative work is taking place in our part of the spectrum. If you have something to tell the rest of us, please let me know and I will be happy to share your news via this, your column. If what you have to say is long enough to be an article, I will consider publishing it in *CQ*'s sister publication, *CQ VHF* magazine. Thank you very much for your ongoing support of this column. Until next month...

73, de Joe, N6CL

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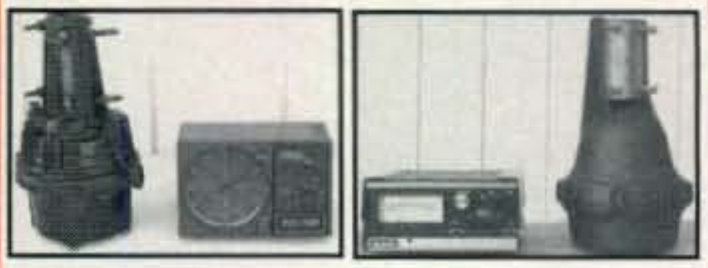

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awards

BY TED MELINOSKY,* K1BV

DX and U.S. Awards

This time we cover awards from both Europe and the United States. We'll begin with an award commemorating Belgium's 175 years of independence.

Belgium's 175th Anniversary

Belgium celebrates 175 years of independence during 2005. You can participate in the celebration by looking for and making contacts with Belgian stations that will be using the special prefix "OO" instead of "ON" during the entire year. For stations outside of Europe, making from 20 to 30 contacts with Belgian stations over the course of an entire year should be fairly easy, especially since Belgium's national amateur radio society, the UBA, sponsors a popular contest as well. Too easy? You can add to the challenge by making contacts to qualify for some of the special endorsements, such as Top Band, All on One Band, and All WARC Band.

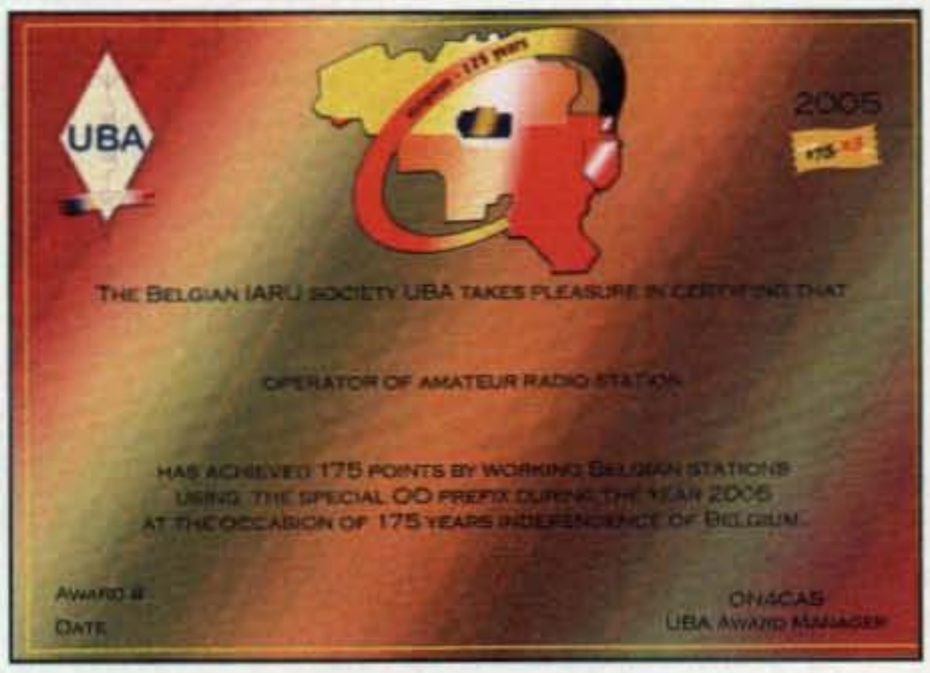
Earn this award by contacting stations using the OO prefix between January 1 and December 31, 2005. At least 175 points are required.

QSO Point Value	Belgian Stations	Other EU Stations	Stations Outside EU
Phone	3	5	6
RTTY, SSTV, PSK31, and other digital modes	4	6	7
CW	5	7	8

QSOs via terrestrial repeaters, packet, and Echolink do not count for the award. Belgian stations using a prefix other than the commemorative OO prefix do not count. The same OO station may be worked one time on each band.

The following eight endorsement stickers are available:

1. "OO" for working at least four different OO prefixes on HF or six on VHF/UHF.



During 2005 you can participate in Belgium's celebration of 175 years of independence by making contacts with Belgian stations that using the special prefix "OO" instead of "ON."

*12 Wells Woods Rd., Columbia, CT 06237
e-mail: <k1bv@cq-amateur-radio.com>

USA-CA Special Honor Roll

Tony Mazzocco, K9MOT
USA-CA All Counties #1107
December 2, 2004

USA-CA Honor Roll

500

OK2PKY	3328
K9MOT	3329
DM3HZN	3330

1000

K9MOT	1680

1500

K9MOT	1402

2000

K9MOT	1298
K2RP	1299

2500

K9MOT	1219

3000

K9MOT	1130

The total number of counties for credit for the United States of America Counties Award is 3077. The basic award fee for subscribers is $6.00. For nonsubscribers it is $12.00. To qualify for the special subscriber rate, please send a recent CQ mailing label with your application. Initial application may be submitted in the USA-CA Record Book, which may be obtained from CQ Magazine, 25 Newbridge Road, Hicksville, NY 11801 USA for $2.50, or by a PC-printed computer listing which is in alphabetical order by state and county within the state. To be eligible for the USA-CA Award, applicants must comply with the rules of the program as set forth in the revised USA-CA Rules and Program dated June 1, 2000. A complete copy of the rules may be obtained by sending an SASE to Ted Melinosky, K1BV, 12 Wells Woods Road, Columbia, CT 06237 USA. DX stations must include extra postage for airmail reply.

2. "WARC" for at least 175 points on the WARC bands exclusively.

3. "Top Band" for at least 175 points exclusively on 160 meters.

4. "Single Band" for at least 175 points using any single band other than 160 meters.

5. "CW" for collecting at least 175 points using exclusively in CW mode.

6. "Single Mode" for at least 175 points using any single mode other than CW.

7. "UBA Contest" for at least an additional 175 points for contacts made during the UBA contests (i.e., 350 points in total are needed for this endorsement).

8. "175 Bonus" for each 175 extra points.

More than one endorsement sticker may be applied for. Endorsement stickers are free when applied for at the same time as the award; otherwise an SASE or an IRC is requested. Send log extract before March 31, 2006 together with the award fee of 5 Euros (Belgian applicants), or 7 Euros or $9 (for stations outside Belgium), to the UBA Award Manager: Egbert Hertsen, ON4CAS, Postbus 85, B-2800 Mechelen, Belgium (e-mail: <egbert.hertsen@pandora.be>; <http://www.uba.be/hf/awards/175yr_en.html>.

Lake Constance Award

Germany, Austria, and Switzerland border on Lake Constance. This award is sponsored by the DARC Friedrichshafen, Germany for contacting stations in the countries' respective call areas or districts which place them in this specific area. The award certificate design is a simple artist's sketch of the lake and the surrounding mountains and dis-

Visit Our Web Site

The Lake Constance Award is sponsored by the DARC Friedrichshafen for contacting stations in the area of Lake Constance. Germany, Austria, and Switzerland border on the lake.

plays the colorful coats of arms of the three countries.

The award is available to amateurs and SWLs. Contacts after January 1, 1965 count. Points needed: DL, OE, HB, and HBØ need 30 points; other EU stations 20 points; all others 10 points. DL, OE, and HB stations must use two different HF bands. At least one station each in DL, OE, and HB is mandatory. They all border on Lake Constance.

Point values:

a. DLs in DOKs A01, A25, A31, A38, T13, and Z29 = 1 point

b. Austrians in OE9 = 1 point.

c. Swiss in Cantons SH, TG, and SG = 1 point.

d. DLs in DOKs P03 and Z18 = 2 points.

e. Club stations DKØFN, DKØFZ, DLØIBO, and DLØDOX = 3 points.

All bands and modes okay. Send GCR list and fee of 10 Euros or $US7 to Emil Igel, DF5UN, Am Hang 10, D-88048 Friedrichshafen, Germany (http://www.mb4ham.de/hp/dw/p03/lca.htm).

Cleddau (Wales) ARS Award Series

Some of the awards we present here are a bit on the challenging side. You might need a rather large QSL collection to have even a small chance of qualifying for some of them. When I ran across the Cleddau Amateur Radio Society's two awards, I knew that this would be a chance to even up the odds just a bit. The requirements are somewhat more modest, the awards are colorful and the fee structure is pretty reasonable. Also, all excess funds go to support GB3AE, the only 6-meter repeater in Wales.

The Six Continents Award is a variation of the Worked All Continents award issued by many IARU member countries, but note that Australia is substituted for Oceania.

General Requirements: Send GCR list and fee of £3.50, $US7, 6 Euros, 750¥, or 11 IRCs to: Award Manager John Rees, GWØJRF, Caerleon, Picton Road, Tenby, Pembrokeshire, SA70 7DP, United Kingdom (http://www.cleddau-ars.org.uk).

Six Continents Award. Work one station on each of the six continents (Africa, North America, South America, Asia, Australia, and Europe) on or after January 1, 1995. All bands and modes.

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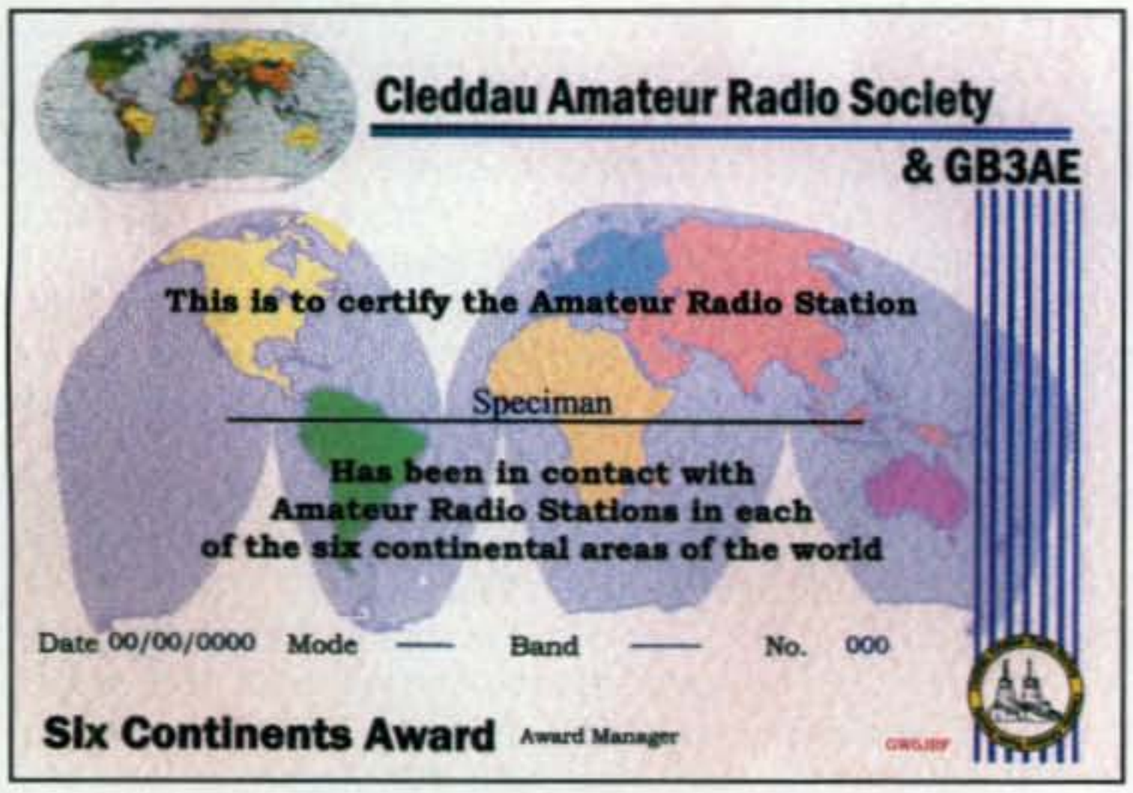

The Cleddau (Wales) ARS and GB3AE sponsor this award for working one station on each of the six continents.

The European Union Award, sponsored by the Cleddau ARS and GB3AE, is issued for contacting stations in each of the European Union member states.

The award may be claimed for any single band. Supply an image of yourself and the picture will appear on the club's website.

European Union Award. Contact stations located in each of the member states that form the European Union on or after January 1, 2000. There are three separate certificates. Class 3 requires 10, Class 2 requires 20, and Class 1 requires 25. All bands and modes. The EU countries are: 5B, 9H, CT, DL, EA, EI, ES, F, G, HA, I, LX, LY, OE, OH, OK, OM, ON, OZ, PA, S5, SM, SP, SV, and YL.

Worked All California Counties Award

The Northern California Contest Club sponsors the Worked All California Counties Award. Each October the California QSO Party gets the contest season off to a good start. The NCCC makes a major effort to have stations operating in all 58 counties, and as far as state QSO parties go, this is a major event with a high level of participation. It's also the best way to work most of the California counties in a single weekend.

Contact each of the 58 California counties after October 1, 1987. All bands and modes okay, but no repeater or digipeater QSOs allowed. The county name must be printed or written on the card of the person issuing the QSL.

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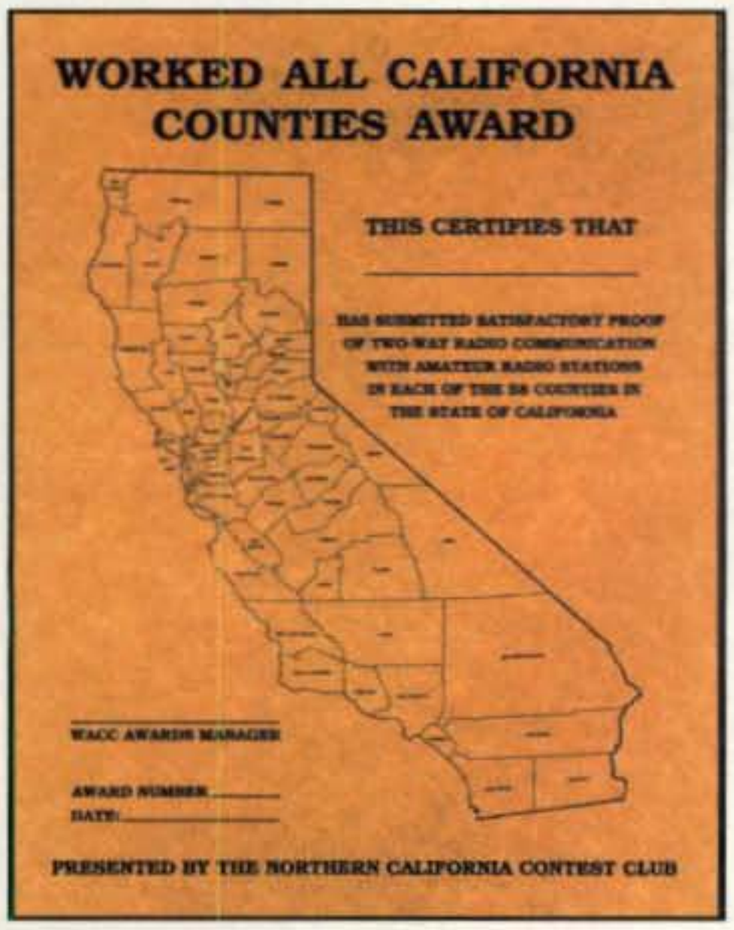

Contact each of the 58 counties in California to earn the Worked All California Counties Award.

Portable and mobiles okay. Contacts must be made from the same country. Endorsements are available by band or mode. Send an SASE to the sponsor for an official application form. Send the 58 cards and $US3 or 10 IRCs to: K.O. Anderson, K6TA, P.O. Box 853, Pine Grove, CA 95665-0853.

U.S. Islands Award Series

Never got a chance to go on an expedition? Would you like to ensure a dose of popularity on the air while not having to venture too far from home? Is there a lake or river with an island big enough to support a small antenna within a few miles of your QTH? Looking for a way to combine hiking, canoeing, QRP, and ham radio? You've found it.

The U.S. Islands Award program covers saltwater and inland fresh-water rivers or lake islands in the 50 states. This means that there are many thousands of possibilities and it includes all of the U.S. states. There are some qualifications that need to be met. You can't operate from a temporary sandbank or small pile of rocks in the river. Can your local island meet these minimal requirements?

1. Totally surrounded by water and a minimum of 100 feet long in any direction, and a minimum of 50 feet from the main shorelines.

2. Does the island name appear on a map of a published source, or as a minimum is it known by that name locally? (The lake or river name must be listed on a map.)

Making it even easier, you may operate from a boat, as long as some part of the radio is physically located on the island.

Once you have decided on the site of your proposed "expedition," you should check with the Qualifications Manager, Ray Phelps, AD4LX. He will review the request, and if this is a new island, he will provide a unique identifying number for you to hand out as you make contacts. You will have to make a minimum of 25 contacts, including two different countries, in order to have this officially recorded as a "new one." If the island has been activated by someone else, he will indicate the existing number, which you may use.

There's a lot more to this program than can be covered here. If you are interested, review the material covered on website: <http://www.eng.mu.edu/~usi/>. It's also another great reason to monitor 14260.

General Requirements: Contact U.S. islands, including inland fresh-water river and lake islands, and saltwater islands, within the 50 states. All HF bands and modes are accepted. Look for island activity on these suggested frequencies: 7250, 14250, 14260, 21350, and 28450 kHz SSB. No cross-band or satellite contacts.

Contact the U.S. Islands Awards Manager: Ray Phelps, AD4LX, 1440 SW 53rd Terrace, Cape Coral, FL, 33914 (e-mail: <ad4lx@arrl.net>; <http://www.eng.mu.edu/~usi/>).

Basic Award: Work 100 U.S. islands (DX stations outside of North America only work 50).

Intermediate and Advanced: Work 300, 500, 750, 1000 U.S. islands.

Worked All States Islands Award: Work one island in each state.

Island Initiator Award: Activate ten "new" U.S. islands.

Island Activator Award: Activate 100 different U.S. islands (old or new).

Certificates (currently free) or plaques are available. Check with the sponsor for pricing.

You are encouraged to submit the rules and a sample copy of your club or group's awards for a future column. Publicity is the key to a successful awards program. 73, Ted K1BV

To earn the basic U.S. Islands Award work 100 islands in the United States (DX outside North America need 50).

Oops!

In our January "How It Works" column, we accidentally identified radio pioneer Major Edwin Howard Armstrong as Major H. C. Armstrong. (H. C. Armstrong, it is rumored, was E. H. Armstrong's little-known twin brother, whose primary radio-related accomplishment was the invention of the "Armstrong rotator" for directional antennas.

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contesting

BY JOHN DORR,* K1AR

Operating Skill vs. Technical Skill Which One Fits You?

March's Contest Tip

If you're like most operators, when operating you favor your RIT and VOX delay as the cherished features of the radio. The fact is you can also benefit from use of your passband tuner, notch filter, AF tune, RF and AGC settings, and other receiver features. Next time you get into a QRM bind, keep these functional characteristics of your transceiver in mind. They just might help you pull out of the mud someone whom you wouldn't copy any other way!

Well, I hate to admit it, but I am a late adopter when it comes to contesting technology. I distinctly remember in the very early days of computer logging how much I resisted the transition from paper, claiming keyboards would do nothing but slow me down. Maybe you were thinking the same thing? In fact, there are some of you who still do. Having now experienced 400+ hourly rates while using a keyboard, I've come to realize how wrong I was.

In a similar way, I was never that crazy about SO2R (single operator, two radios). This situation is a little different, in that I saw the advantage, but didn't like the pain of dealing with two radios, especially over a 48-hour DX contest. However, for this month's discussion, I do digress. The point is that this hobby indeed is made up of gadget freaks . . . and boy, do we like to talk about them. It seems that there is an e-mail reflector or blog source for practically every technical topic imaginable, and this is in a day when we criticize ourselves as a group for losing our technical roots.

In reality, our hobby is dominated by two areas of focus: on-the-air operating and technology. Contesters have always been known as ham radio's specialists who have tried to push the state-of-the-art to new levels. We are widely known for our leadership in antenna design, station implementation, and computer applications. By definition, we are also known for our operating acumen. The nature of the sport is such that both of these aspects seem to go hand in hand.

Achieving a Balance

As the number of gadgets has increased over the years, so has the quantity (and quality) of conversation around them. There's nothing like a new and innovative antenna design or recently announced transceiver to generate seemingly endless discussions about how those to first adopt the new technology are going to gain a significant competitive edge in the next contest. This month I'm here to report that we need some balance in all of this. A few of you may have read a "tongue and cheek" e-mail post I sent to the CQ-Contest e-mail reflector a few weeks ago. It was intended to stir up the pot a bit, as I alleged that few technocrats ultimately win contests. Rather, contests are won by skill, experience, relevant on-the-air knowledge, an appropriate QTH, and good old-fashioned luck.

The fact is that while I personally appreciate the intensity of debate over noise floors, receiver sensitivity, antenna gain, and the like, I believe that as a group of operators we also need to make sure we are keenly aware of the other critical factor that affects contest scores—our on-the-air abilities. While I somehow managed to obtain a couple of engineering degrees in my distant past, I've always had a passion for being on the air as a ham more than heating a soldering iron. Frankly, all of the talk of the advantages that come from an extra element here or there bores me to tears. That's really the focus of this month's discussion. As contesters, we need to achieve an effective balance between our technical interests and our ability to operate the radios that we strive to understand.

It pains me to witness on-the-air experiences in which well-known contesters can't copy conversational CW, or the fact that they are unaware of recent callsign changes in a certain country. From my point of view, these factors are just as important as the time it takes to design the perfect Yagi. In contrast, I'm sure it pains many technical folks to see the cold sweat that develops on many of our brows when it becomes necessary to take the screws out of the top cover of a malfunctioning transceiver.

Any Secrets?

At the end of the day, the perfect antenna or fully functional radio will never prevail if you don't have

Calendar of Events

Feb. 26–27	**CQ WW 160M SSB Contest**
Feb. 26–27	REF SSB Contest
Feb. 26–27	UBA CW DX Contest
Feb. 26–27	North American RTTY QSO Party
Feb. 26–27	Mississippi QSO Party
Feb. 27–28	North Carolina QSO Party
Mar. 5–6	ARRL SSB DX Contest
Mar. 12–13	RSGB Commonwealth Contest
Mar. 12–13	Oklahoma QSO Party
Mar. 13	North American RTTY Sprint
Mar. 13	UBA CW Spring Contest
Mar. 13–14	Wisconsin QSO Party
Mar. 19–20	BARTG RTTY Contest
Mar. 19–20	Russian DX Contest
Mar. 19–20	CLARA and Family HF Contest
Mar. 19–21	Virginia QSO Party
Mar. 27–28	**CQ WW WPX SSB Contest**
Apr. 2–3	SP DX Contest
Apr. 2–3	EA RTTY Contest
Apr. 2–3	Missouri QSO Party
Apr. 2–3	QCWA Spring QSO Party

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e-mail: <K1AR@contesting.com>

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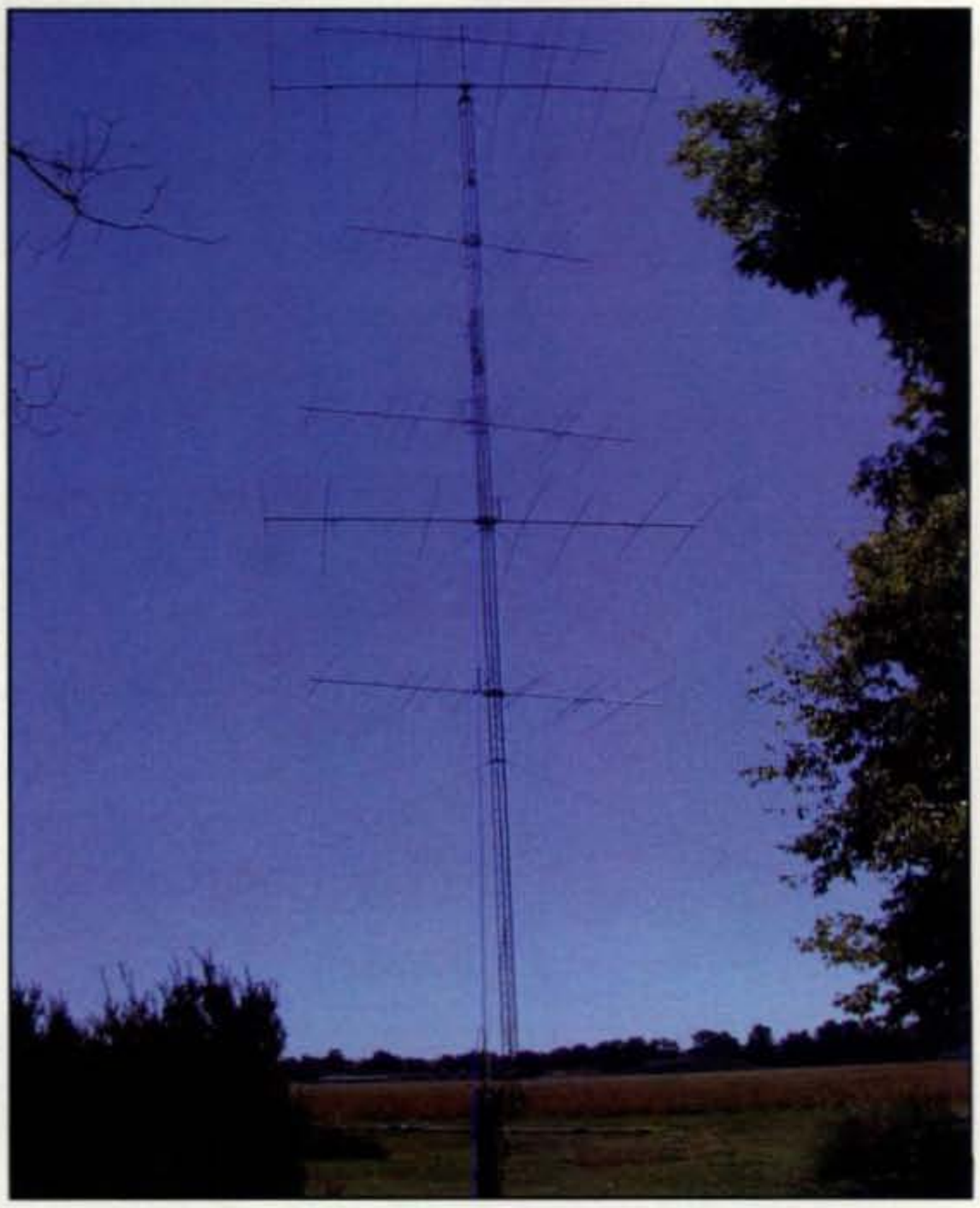
the proper skills and insight to use it. I've always believed that contesting is actually a simple sport to master. It begins with a strong commitment to operating excellence. That excellence will only come from being active and putting in your time. There simply are no shortcuts. Second, you need to be an active ham. Successful contesters benefit from knowing their surroundings, whether it's understanding propagation (in general plus time-sensitive knowledge) or who's operating where. Last, you have to match your QTH to your contest goals. If you want to specialize in the ARRL Sweepstakes, a fine New England location is not going to get that done for you.

Remember that a contest has rarely been lost because of one less element or the choice of one radio over another. That said, contests have rarely been won by randomly throwing together a bunch of junk and hoping for the best. Technical matters as well as operating excellence are inseparable. If there's any secret at all, it's being the best at balancing both of them in a way that works for you. You may not win the next contest, but proper perspective will certainly make for improved scores. I guarantee it!

A Bad Day in Indiana

Many of you are aware of the fine station that Pat Barkey, N9RV, has been building at his Albany, Indiana location. Unfortunately, Pat recently discovered that the ravages of winter can take their toll when building a large station, as you can see by the accompanying "before" and "after" photos of his antenna farm. Here is a brief summary of the damage, as reported by Tim Duffy, K3LR: "Pat's basement has 4 inches of water in it. He has not had power for over 24 hours. The entire county has no power. Ball State University (where Pat



The impressive antenna farm at the QTH of Pat Barkey, N9RV. (Photos courtesy N4TZ)

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The antennas at N9RV lost a classic winter battle after succumbing to a fierce Indiana ice storm.

works) is deserted. He went to work to warm up and stay away from falling debris. He has 1-inch of radial ice on his antennas and towers."

Antenna damage (at the time of this report):

- All 80-meter Hy-Towers broke in the middle.
- The 40-meter OWA antenna has a broken boom in two places.
- The 2-element Cushcraft 40 at 140 feet broke into pieces.
- The three-high 20-meter stack is gone—all elements and booms broken.
- The four-high 15-meter stack is gone (broken booms, broken elements) with only the beam at 40 feet still intact.
- Several of the antenna masts are bent.

If there is any good news in all of this, it's the fact that Pat is already working on the rebuild plan. I'm not sure any amount of engineering could have prevented this catastrophe, but suffice it to say that if anyone can come back with even a greater competitive spirit, it will be N9RV. Good luck, Pat!

Final Comments

That does it for this month. Thankfully, the winter is nearly behind us and we can look forward to warm weather and new antennas. Until next month, see you in the contest!

73, John, K1AR

Correction to 2003 CQ WW DX SSB Contest Results

YMØT, operated by TA2RC, was incorrectly placed in Europe in the results in the August 2004 issue of *CQ*. His location was Asia, and his line score should have been listed as follows: 1,379,000 points, 1420 Qs, 70 zones, 280 countries.

60 Great Things About Ham Radio

1945 CQ 2005 60th Anniversary

In celebration of *CQ*'s 60th anniversary in 2005, we've come up with 60 great things about ham radio, which we'll bring you each month, five at a time. We're sure you'll have more great things that we haven't thought of, so when we're all done, we'd love to compare our list with yours.—*W2VU*

This month, we'll focus on some of the unique experiences ham radio offers.

11. How many of your non-ham friends have actually *talked* to someone in some remote place like Cape Verde or the Seychelles? Lots of people will tell you that the internet or even the plain old telephone will let you talk to just about anyone just about anywhere. But most of the time, you have to know someone there before you call on the phone or send an e-mail. Calling CQ, and getting an answer, is unique to ham radio.

12. How many of your non-ham friends might have talked to an astronaut aboard the space station? Unless you happen to work for NASA, the answer is most likely none. Hams are the only "civilians" permitted to make direct radio contact with astronauts while in orbit.

13. How many of your non-ham neighbors might have a TV studio in their garage? To most people, radio and TV are one-way devices. They listen or watch and are *consumers* of information. And while most communities with cable systems have a public access channel, you generally need to use their studio and get somebody's approval before going on the air. Hams are different. We are both consumers and *producers* of information, and our licenses allow us to get on the air without anyone looking over our shoulders, and even send out TV as well as radio signals.

14. How many of your non-ham neighbors might have a satellite uplink station in their basements? Think about this one—satellite *downlink* stations are popping up everywhere, but how many people do you know who can send signals *up* to a satellite? Again, unless you're in the satellite, TV or telecomm biz, you can only transmit up to a satellite if you're a ham.

15. What other hobby group has designed, built and had launched its own fleet of communication satellites? None. Period. OSCAR-1 was the first non-governmental satellite ever put into orbit (yes, even before Telstar), and ham radio has continued to be a spacefaring hobby ever since 1961. Plus, the SAREX and MAREX programs have put ham radio aboard manned space flights and space stations since 1983.

We'll be back next month with another installment...

The VU4 DXpedition Team and the Tsunami Disaster

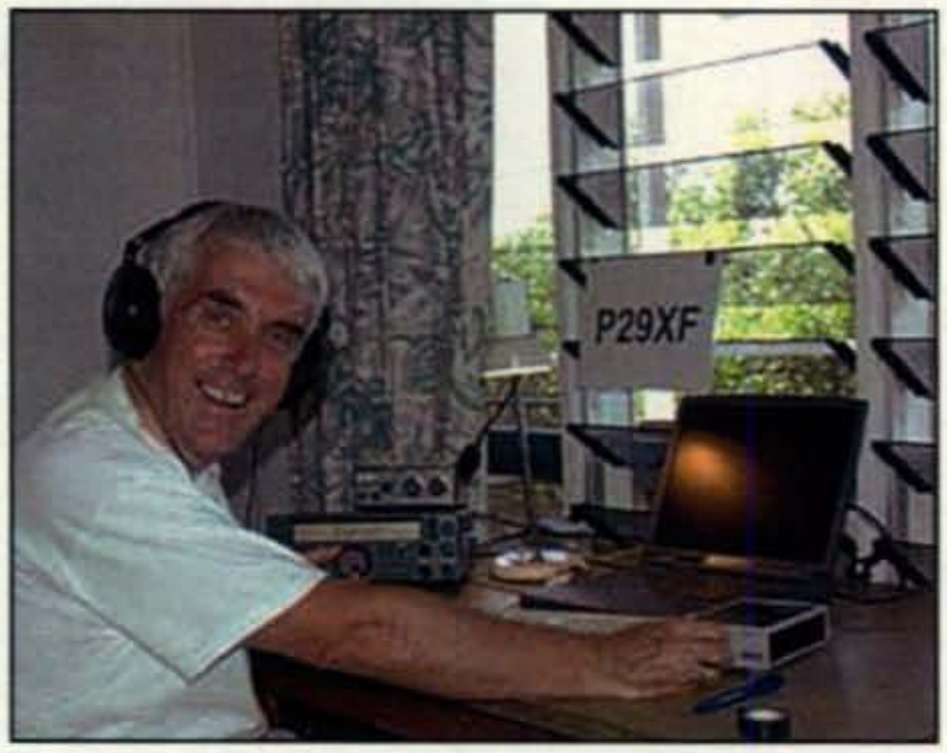
BY CARL SMITH,* N4AA

The new year sure got started off with a "bang." Pardon the pun, but with the earthquakes that set off the tsunamis across the Indian Ocean, there was definitely a wake-up call. Tens of thousands dead, billions of dollars in damage, and countless lives affected across the world.

If there was anything positive about the end of December 2004, it was the fact that radio amateurs were able to help in the midst of the devastation. The Indian amateurs who had been on the air from the Andamans since the first of December were at Port Blair when the tsunami hit. As is the case so often in times of disaster, ham radio proved to be the only means of communication from the Andamans for some time. Those DXpeditioners, who only moments before the tsunami struck were handing out QSOs to DXers around the world, turned their attention to helping their fellow man by providing a vital communications link to the outside world.

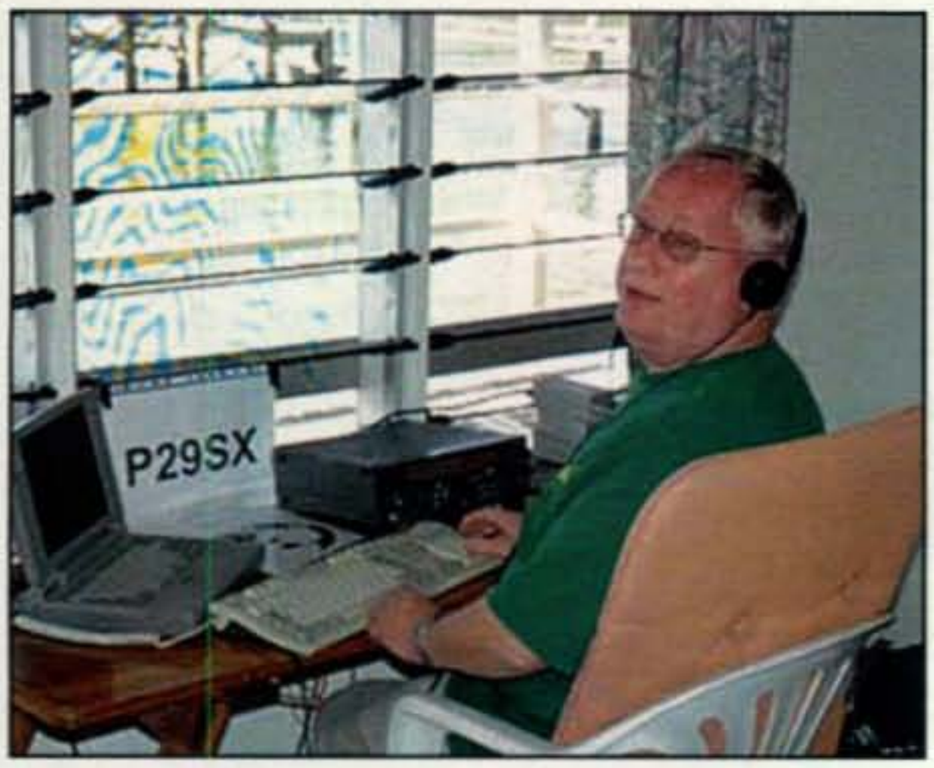
Was their presence on this rare island at that particular moment in time pure chance? They certainly had no warning that the disaster would take place, and they definitely had no way of knowing it would happen only a few days before their operation was to end. I leave it to the reader to decide the answer to this question. In any event, they were there and were able to provide a vital communications link until conventional services could be restored. My hat is off to the VU4 operators, who all survived and who proved once again that members of the Amateur Radio Service can do things no one else can do.

*P.O. Box DX, Leicester, NC 28748-0249
e-mail: <n4aa@cq-amateur-radio.com>



Nigel, G3TXF/P29XF, at his WARC band operating position in Papua New Guinea. (Photo courtesy of Nigel, G3TXF)

I would be remiss if I failed to mention Charles Harpole, K4VUD, in connection with the Andamans. Charles is married to a Thai lady. They were visiting her family in Thailand, but he took time to go to Port Blair to visit with the Indian amateurs during their operation. He was actually on the fifth floor of a hotel in Port Blair when the tsunami hit there. Scheduled to fly out of the Andamans on Monday, the day after the disaster, he was in fact able to do



Roger, G3SXW/P29SX, at his operating position in Papua New Guinea late last year. (Photo courtesy of Nigel, G3TXF)

(Left to right) John, ON4UN, accepts a gift from Bill Smith, W9VA, at the 2004 W9-DXCC Convention. John was the featured speaker at the convention banquet. (Photo courtesy of Bill, W9VA)

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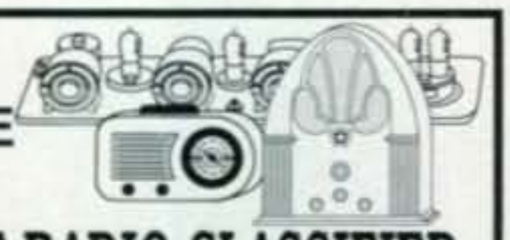

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The WPX Program

CW

3147.....K6TV

SSB

2922.....CT2FUH 2923.....N6PSN

CW: 600 AA4FU. 900 PP6CW. 1150 WA2VQV. 1250 K6UXO. 1600 JA6GWU. 2500 I7PXV. 2550 I7PXV.
MIXED: 650 WB5JID. 1250 K6UXO. 2550 OZ1ACB. 2600 OZ1ACB. 2650 OZ1ACB. 2700 OZ1ACB. 2750 OZ1ACB. 3550 I5RFD. 3950 WB2YQH.

15 Meters: JH8GWT, PP6CW

Award of Excellence Holders: N4MM, W4CRW, K5UR, K2VV, VE3XN, DL1MDD, DJ7CX, DL3RK, WB4SIJ, DL7AA, ON4QX, 9A2AA, OK3EA, OK1MP, N4NO, ZL3GO, W4BQY, IØJX, WA1JMP, KØJN, W4VQ, KF2O, WB8CNL, W1JR, F9RM, W5UR, CT1FL, WA4QMQ, W8ILC, VE7DP, K9BG, W1CU, G4BUE, N3ED, LU3YL/W4, NN4Q, KA3A, VE7WJ, VE7IG, N2AC, W9NUF, N4NX, SMØDJZ, DK5AD, WD9IIC, W3ARK, LA7JO, VK4SS, I8YRK, SMØAJU, N5TV, W6OUL, WB8ZRL, WA8YTM, SM6DHU, N4KE, I2UIY, I4EAT, VK9NS, DEØDXM, DK4SY, UR2QD, AB9O, FM5WD, I2DMK, SM6CST, VE1NG, I1JQJ, PY2DBU, HI8LC, KA5W, K3UA, HA8UB, HA8XX, K7LJ, SM3EVR, K2SHZ, UP1BZZ, EA7OH, K2POA, N6JV, W2HG, ONL-4003, W5AWT, KBØG, HB9CSA, F6BVB, YU7SF, DF1SD, K7CU, I1POR, K9LJN, YBØTK, K9QFR, 9A2NA, W4UW, NXØI, WB4RUA, I6DQE, I1EEW, I8RFD, I3CRW, VE3MS, NE4F, KC8PG, F1HWB, ZP5JCY, KA5RNH, IV3PVD, CT1YH, ZS6EZ, KC7EM, YU1AB, IK2ILH, DEØDAQ, I1WXY, LU1DOW, N1IR, IK4GME, VE9RJ, WX3N, HB9AUT, KC6X, N6IBF, W5ODD, IØRIZ, I2MQP, F6HMJ, HB9DDZ, WØULU, K9XR, JAØSU, I5ZJK, I2EOW, IK2MRZ, KS4S, KA1CLV, WZ1R, CT4UW, KØIFL, WT3W, IN3NJB, S50A, IK1GPG, AA6WJ, W3AP, OE1EMN, W9IL, I7PXV, S53EO, DF7GK, S57J, EA5BM, DL1EY, DJ1YH, KUØA, VE2UW, 9A9R, UAØFZ, DJ3JSW, OE6CLE, HB9BIN, N1KC, SM5DAC, RW9SG, WA3GNW, S51U, W4MS, I2EAY, RAØFU, CT4NH, EA7TV, W9IAL, LY3BA, K1NU, W1TE, UA3AP, EA5AT, OK1DWC, KX1A, IZ5BAM, K4LQ, KØKG, DL6ATM, VE9FX, DL2CHN, W2OO, AI6Z, RU3DX, WB9IHH, CT1EEN, G4PWA, OK1FED, EU1TT.

160 Meter Endorsements: N4MM, W4CRW, K5UR, VE3XN, DL3RK, OK1MP, N4NO, W4BQY, W4VQ, KF2O, W8CNL, W1JR, W5UR, W8ILC, K9BG, W1CU, G4BUE, LU3YL/W4, NN4Q, VE7WJ, VE7IG, W9NUF, N4NX, SMØDJZ, DK5AD, W3ARK, LA7JO, SMØAJU, N5TV, W6OUL, N4KE, I2UIY, I4EAT, VK9NS, DEØDXM, UR2QD, AB9O, FM5WD, SM6CST, I1JQJ, PY2DBU, HI8LC, KA5W, K3UA, K7LJ, SM3EVR, UP1BZZ, K2POF, IT9TQH, N6JV, ONL-4003, W5AWT, KBØG, F6BVB, YU7SF, DF1SD, K7CU, I1POR, YBØTK, K9QFR, W4UW, NXØI, WB4RUA, I1EEW, ZP5JCY, KA5RNH, IV3PVD, CT1YH, ZS6EZ, YU1AB, IK4GME, WX3N, W5ODD, IØRIZ, I2MQP, F6HMJ, HB9DDZ, K9XR, JAØSU, I5ZJK, I2EOW, KS4S, KA1CLV, KØIFL, WT3W, IN3NJB, S50A, IK1GPG, AA6WJ, W3AP, S53EO, S57J, DL1EY, DJ1YH, KUØA, VR2UW, UAØFZ, DJ3JSW, OE6CLD, HB9BIN, N1KC, SM5DAC, S51U, RAØFU, CT4NH, EA7TV, LY3BA, K1NU, W1TE, UA3AP, OK1DWC, KX1A, IZ5BAM, DL6ATM, W2OO, RU3DX, WB9IHH, G4PWA, OK1FED, EU1TT.

Complete rules and application forms may be obtained by sending a business-size, self-addressed, stamped envelope (foreign stations send extra postage if airmail desired) to "CQ WPX Awards," P.O. Box 593, Clovis, NM 88101 USA. *Note: WPX will not accept prefixes/calls which have been confirmed by computer-generated electronic means.*

Please Note: As of February 2004, the price of the 160 meter bar for the Award of Excellence is now $6.50.

just that, flying to Bangkok. After arriving in Thailand, where he had a station set up at his in-laws' house, he was able to listen to the emergency radio communications and provide assistance when possible, although there was a language problem for him. He provided the DX community with almost daily updates on the situation in the area for several days, allowing us to keep up with the events as they developed.

The Indian government reportedly was very pleased with the efforts of their radio amateurs. In fact, a large number of Indian amateurs were sent to various islands to provide additional communications links. It is expected that amateur radio in India will receive some well-deserved publicity for its work.

Peter I

By the time you read this, the major DXpedition to Peter I should be over. At this writing I can only hope that the team was able to meet its goal of providing this very rare "country" to everyone who needed it. I also trust the team will have returned home safely.

I'll have more about the operation after they get back and have time to provide more details. This was being advertised as the most expensive DXpedition ever, mostly due to the transportation costs. Some 20 individuals were on the team. These hearty individuals invested thousands of dollars from their own pockets and took off several weeks from their work. The trip was

CQ DX Awards Program

SSB

2451.....SV1EOS

SSB Endorsements

320.....N4JF/335
320.....N6AW/334
320.....W2FKF/332
320.....WA4ZZ/322
300.....4X6DK/301
275.....K7SAM/283
200.....UA1ZKF/200
3.5/7 MHz.....UA1ZKF

CW Endorsements

320.....F3TH/334
320.....K7LAY/331
320.....N6AW/329
320.....SM5HV/HK7/327
320.....K1FK/324
310.....F6HMJ/319

The basic award fee for subscribers to *CQ* is $6. For non-subscribers, it is $12. In order to qualify for the reduced subscriber rate, please enclose your latest *CQ* mailing label with your application. Endorsement stickers are $1.00 each plus SASE. Updates not involving the issuance of a sticker are free. All updates and correspondence must include an SASE. Rules and application forms for the CQ DX Awards may be found on the <www.cq-amateur-radio.com> website, or may be obtained by sending a business-size, self-addressed, stamped envelope to CQ DX Awards Manager, Billy Williams, N4UF, Box 9673, Jacksonville, FL 32208 U.S.A. Currently we recognize 335 active countries. Please make all checks payable to the award manager.

5 Band WAZ

As of January 1, 2005, 666 stations have attained the 200 zone level and 1420 stations have attained the 150 zone level.

New recipients of 5 Band WAZ with all 200 zones confirmed:

UA6AF UR5LCV

The top contenders for 5 Band WAZ (zones needed, 80 meters):

N4WW, 199 (26)
W4LI, 199 (26)
K7UR, 199 (34)
WØPGI, 199 (26)
W2YY, 199 (26)
VE7AHA, 199 (34)
IK8BQE, 199 (31)
JA2IVK, 199 (34 on 40m)
IK1AOD, 199 (1)
DF3CB, 199 (1)
GM3YOR, 199 (31)
VO1FB, 199 (19)
KZ4V, 199 (26)
W6DN, 199 (17)
W6SR, 199 (37)
W3NO, 199 (26)
HB9DDZ, 199 (31)
RU3FM, 199 (1)
HB9BGV, 199 (31)
N3UN, 199 (18)
OH2VZ, 199 (31)
K5MC, 199 (22)
W1JZ, 199 (24)
W1FZ, 199 (26)
SM7BIP, 199 (31)
PY5EG, 199 (23)
SP5DVP, 199 (31 on 40)
W8AEF, 199 (40)
K8RR, 199 (26)
UU5JR, 199 (4)
W8GF, 199 (22)
N4NX, 199 (26)
N4MM, 199 (26)
EA7GF, 199 (1)
N4PQX, 199 (26)
JA5IU, 199 (2)
N6HR/7, 199 (37)
CT3DL, 199 (26)
EA5BCX, 198 (27, 39)
G3KDB, 198 (1, 12)
KG9N, 198 (18, 22)
JA1DM, 198 (2, 40)
9A5I, 198 (1, 16)
K5PC, 198 (18, 23)
K4CN, 198 (23, 26)
G3KMQ, 198 (1, 27)
N2QT, 198 (23, 24)
OK1DWC, 198 (6, 31)
W4UM, 198 (18, 23)
US7MM,198 (2, 6)
K2TK, 198 (23, 24)
K3JGJ, 198 (24, 26)
W4DC, 198 (24, 26)
N4XR, 198 (22, 27)
RU3DX, 198 (1, 6)
OE2LCM, 198 (1, 31)
W7SX, 198 (18, 23)
HA1RW, 198 (1, 31)
WK3N, 198 (23, 24)
HA9RT, 198 (1, 31)
W9XY, 198 (22, 26)
KZ2I, 198 (24, 26)
NØIJ, 198 (21, & 15 on 15m)

The following have qualified for the basic 5 Band WAZ Award:

LY3UM (197 zones) IKØOER (162 zones)
NØIJ (198 zones)

****Please note: Cost of the 5 Band WAZ Plaque is $80 ($100 if airmail shipping is requested).**

Rules and applications for the WAZ program may be obtained by sending a large SAE with two units of postage or an address label and $1.00 to: WAZ Award Manager, Floyd Gerald, N5FG, 17 Green Hollow Rd., Wiggins, MS 39577. The processing fee for the 5BWAZ award is $10.00 for subscribers (please include your most recent *CQ* mailing label or a copy) and $15.00 for nonsubscribers. An endorsement fee of $2.00 for subscribers and $5.00 for nonsubscribers is charged for each additional 10 zones confirmed. Please make all checks payable to Floyd Gerald. Applicants sending QSL cards to a *CQ* checkpoint or the Award Manager must include return postage. N5FG may also be reached via e-mail: <n5fg@cq-amateur-radio.com>.

The WAZ Program

17 Meter CW

56 ..... HB9BGV

20 Meter CW

547 ..... UA9SC

30 Meter CW

62 ..... HB9BGV 63 ..... JA8IYI

20 Meter RTTY

55 ..... HL3IB

6 Meters

68 ..... IKØPEA (25 zones)

All Band WAZ SSB

4946 ..... ABØOW 4948 ..... AE9DX
4947 ..... VE3DWH 4949 ..... ISØIGV

Mixed

8336 ..... LY2UM 8340 ..... RKØSXF
8337 ..... N4HL 8341 ..... PA3EBP
8338 ..... WØHT 8342 ..... UR5LCV
8339 ..... NØIJ 8343 ..... JA3AVO

All CW

449 ..... IV3DYS 450 ..... W9HR

Rules and applications for the WAZ program may be obtained by sending a large SAE with two units of postage or an address label and $1.00 to: WAZ Award Manager, Floyd Gerald, N5FG, 17 Green Hollow Rd., Wiggins, MS 39577. The processing fee for all *CQ* awards is $6.00 for subscribers (please include your most recent *CQ* mailing label or a copy) and $12.00 for nonsubscribers. Please make all checks payable to Floyd Gerald. Applicants sending QSL cards to a *CQ* checkpoint or the Award Manager must include return postage. N5FG may also be reached via e-mail: <n5fg@cq-amateur-radio.com>.

to take a total of six weeks, most of that time spent traveling to this extremely remote island in the Antarctic region. I suspect most of you have already seen the website, but for those of you who have not, take a look at <http://www.peterone.com> and see for yourself what this "hunk of ice" is all about.

Current/Upcoming DXpeditions

We still have some of those Most Wanted "countries" DXpeditions either on the air now or about to be on the air in the next month or so.

The operation from Crozet (FT5W) should continue until around April 1. The DXpedition to Kerguelen (FT/X) is due to start up in mid-March for continue for about three weeks. Then there is a short break until May, when an operation from Glorioso (FR/G) is expected. All of these are among the top Most Wanted and are sure to generate some huge pile-ups. Hopefully the propagation will be kind to DXers and we all will be able to work these groups as we need them.

There is some action by a group working to get the islands of Navassa and Descheo "unfrozen" by the U.S. government. While we won't know the results of their efforts for a while, they certainly have high expectations of having some good news for DXers in 2005. These islands haven't seen any ham activity for several years now. They are ranked #7 and #8 on the 2004 Most Wanted Survey by *The DX Magazine*, and a DXpedition to one or both of them would be welcomed by DXers around the world.

As to WW2CQ/6x . . . sorry, but you folks who worked one of these stations and thought you were working Somalia (6O) were not. This callsign was used for the first 60 days of 2005 to celebrate the 60 years of publication of *CQ* mag-

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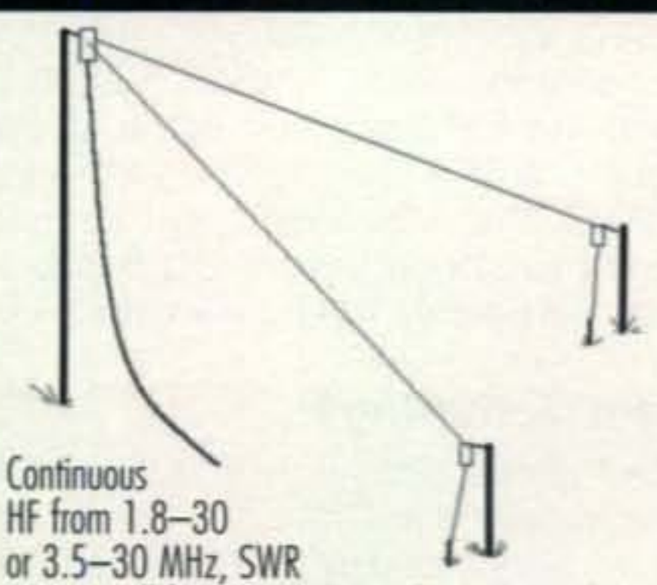

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CQ DX Honor Roll

The CQ DX Honor Roll recognizes those DXers who have submitted proof of confirmation with 275 or more ACTIVE countries. With few exceptions, the ARRL DXCC Countries List is used as the country standard. The CQ DX Award currently recognizes 335 countries. Honor Roll listing is automatic when an application is received and approved for 275 or more active countries. Deleted countries do not count and all totals are adjusted as deletions occur. To remain on the CQ DX Honor Roll, annual updates are required. All updates must be accompanied by an SASE if confirmation of total is required. The fee for endorsement stickers is $1.00 each plus SASE. Please make checks payable to the awards manager, Billy F. Williams. All updates should be mailed to P.O. Box 9673, Jacksonville, FL 32208.

CW

K2TQC 334	K4MQG 334	N5FG 333	N4CH 332	YU1TR 330	N4KG 327	K1FK 324	F6HMJ 319	KH6CF 301
K2FL 334	EA2IA 334	N7RO 333	K6LEB 331	W4UW 330	K4JLD 327	YV5ANT 324	OZ5UR 319	VE7KDU 300
K9BWQ 334	PA5PQ 334	K4CN 333	VE3XN 331	G3KMQ 329	W6OUL 327	9A2AJ 323	PY4WS 319	KØHQW 299
K9MM 334	K3UA 334	W4MPY 333	W1WAI 331	KZ4V 329	SM5HV/HK7 327	W6SR 323	G3KMQ 317	WG7A 295
W7OM 334	DL3DXX 334	PY2YP 333	K2JF 331	N5HB 329	IT9TQH 326	N5ZM 323	YT1AT 317	KE3A 295
K2JLA 334	K2ENT 334	W8XD 333	K3JGJ 331	W9IL 329	I2EOW 326	KUØS 322	K8JJC 315	K4IE 291
N7FU 334	OK1MP 334	W2VJN 333	PT2TF 331	K1HDO 329	W7IIT 326	KE5PO 322	CT1YH 313	KD8IW 288
K2OWE 334	NC9T 334	KA7T 332	WA8DXA 331	K7JS 329	K6CU 326	HA5DA 321	N1HN 313	WA4DOU 286
N4MM 334	WB5MTV 333	WØJLC 332	K9IW 331	N6AW 329	W4LI 325	IKØTUG 321	W6YQ 313	G3DPX 284
F3TH 334	W7CNL 333	K8LJG 332	WB4UBD 331	K9OW 328	I5XIM 325	VE7DX 320	K9DDO 312	EA3BHK 282
F3AT 334	YU1HA 333	YU1AB 332	K7LAY 331	K8PV 327	K5UO 325	IKØADY 320	W3II 312	YC2OK 282
DJ2PJ 334	IT9QDS 333	K5RT 332	W2UE 330	W4QB 327	IK2ILH 325	WG5G/QRPp 320	UA9SG 309	DJ1YH 281
WA4IUM 334	G4BWP 333	YU1AB 332	I4LCK 330	I1JQJ 327	N5FW 325	N7WO 320	KF8UN 308	XE1MD 278
W4OEL 334	K4CEB 333	NØFW 332	VE7CNE 330	I4EAT 327	9A2AA 325	F5OIU 320	YU7FW 306	EA2CIN 278
W2FXA 334	K4IQJ 333	N4AH 332	4N7ZZ 330	DL8CM 327	N4OT 325	KA3S 320	LU3DSI 302	I3ZSX 276
N4JF 334	WØHZ 333	HB9DDZ 332	W6DN 330	SM6CST 327	LA7JO 324	HA5NK 319	N1KC 302	

SSB

K6YRA 335	N7RO 335	EA3KB 334	LU4DXU 332	I2EOW 329	I1JQJ 327	XE1CI 321	EA3BHK 307	KØOZ 291
K2TQC 335	IØZV 335	N4CH 334	VE4ROY 332	VE7DX 329	CP2DL 327	CT1ESO 321	RW9SG 307	W9ACE 291
W6EUF 335	EA2IA 335	K3UA 334	W7FP 332	W2FGY 329	NI5D 327	EA8TE 321	W9IL 306	I3ZSX 290
K2JLA 335	IN3DEI 335	K4JLD 334	K9HQM 332	CT1CFH 329	W6SR 326	W6MFC 321	XE1MDX 305	N2LM 286
K4MQG 335	EA4DO 335	N5ZM 334	CT1EEB 332	EA1JG 329	N4KG 326	KD5ZD 321	EA5OL 305	KKØDX 285
IK1GPG 335	PA5PQ 335	PY2YP 334	W2FKF 332	KE4VU 328	K7TCL 326	N4CSF 320	WB2AQC 305	VE7HAM 285
K5OVC 335	K9OW 335	AA4S 334	CT1EEN 332	K5UO 328	W9HRQ 326	N4HK 320	VE7SMP 305	F5RRS 284
NØFW 335	W6DPD 335	CT3DL 334	DL9OH 331	KF8UN 328	W4QB 326	KØFP 320	KC4FW 304	N8LIQ 284
K9MM 335	XE1VIC 335	NC9T 334	N2VW 331	WØULU 328	K8PV 326	EA7TV 320	K3BYV 303	WØIKD 283
W6BCQ 335	K2ENT 335	W9SS 334	YV1JV 331	K1EY 328	DL6KG 326	SV1RK 320	YC2OK 303	K7SAM 283
XE1AE 335	OK1MP 335	VE7WJ 334	WA4WTG 331	KZ4V 328	W4LI 326	N1KC 320	WB2NQT 303	KBØRNC 282
W7OM 335	IZ6GPZ 335	VE2PJ 334	W8KS 331	XE1D 328	N1ALR 326	W5GZI 320	VK3IR 303	WN6J 281
KZ2P 335	K1UO 335	W3AZD 334	YV5IVB 331	KD8IW 328	HB9DDZ 326	SV3AQR 320	KK4TR 303	IK8TMI 281
IK8CNT 335	I8KCI 335	YZ7AA 334	KX5V 331	KE3A 328	WR5Y 325	WA4DAN 319	JR4NUN 303	F5JSK 281
VK4LC 335	I8LEL 335	CT3BM 334	K3JGJ 331	W9IL 328	WA4JTI 325	CE1YI 318	VE7KDU 302	KA5OER 280
OE7SEL 335	DU9RG 335	N6AW 334	N5ORT 331	K3LC 328	KC4MJ 325	W5OXA 317	W5GZI 302	KK5UY 280
VE3MR 335	DU1KT 335	4N7ZZ 333	PT2TF 331	K8DXA 328	PY2DBU 325	YV4VN 317	N5QDE 302	F5INJ 279
VE3MRS 335	N4JF 335	KE5PO 333	CT1AHU 331	LU5DV 328	IKØIOL 325	EA5GMB 317	KD4YT 302	EA3CWT 278
K4MZU 335	WDØBNC 334	VE1YX 333	EA3JL 331	I1EEW 327	YT1AT 325	KE4SCY 317	YV2FEQ 301	VE2DRN 277
OZ5EV 335	K2FL 334	I4LCK 333	K9IW 331	SV1ADG 327	K7HG 324	K6RO 316	AC6WO 301	9A9R 277
N7BK 335	WØYDB 334	W2JZK 333	K1HDO 331	DL8CM 327	AC7DX 324	N5HSF 316	4X6DK 301	W6UPI 276
K7LAY 335	W4UW 334	K8LJG 333	W6DN 330	F9RM 327	KØHQW 324	N8SHZ 316	SV2CWY 300	W5GT 276
ZL3NS 335	K9BWQ 334	VE4ACY 333	K8CSG 330	XE1MD 327	EA3BKI 323	WZ3E 314	4X6DK 300	Z31JA 275
N4MM 335	W4NKI 334	KØKG 333	YV1CLM 330	I4EAT 327	K4JDJ 323	IZ6CST 314	YT7TY 300	G4URW 275
OZ3SK 335	WB4UBD 334	W4WX 333	LA7JO 330	W3GG 327	W6WI 323	K9YY 313	N5WYR 300	VE2AJT 275
K7JS 335	W4UNP 334	VE2WY 333	AB4IQ 330	AA6BB 327	EA3CYM 323	NØMI 313	K4IE 300	4Z5FL/M 275
XE1L 335	W8AXI 334	WB3DNA 333	AE5DX 330	SM6CST 327	F6BFI 322	W7GAX 312	W4PGC 300	KU4BP 275
YU1AB 335	VE2GHZ 334	K9PP 333	KB2MY 330	WD8MGQ 327	K6CF 322	VE3CKP 311	K6GFJ 299	
OE3WWB 335	OE2EGL 334	W2CC 333	K3PT 330	CX4HS 327	LU7HJM 322	CT1YH 311	WØROB 296	
K5TVC 335	WA4IUM 334	DL3DXX 333	ZL1BOQ 330	IØSGF 327	K5NP 322	YV5NWG 311	WA1ECF 295	
N5FG 335	K5RT 334	EA3BMT 333	KW7J 330	IT9TGO 327	WA4ZZ 322	LU3HBO 310	KW1DX 295	
DJ9ZB 335	W2FXA 334	EA3EQT 333	WS9V 329	IT9TQH 327	WN9NBT 322	HA6NF 310	K7ZM 292	
PY4OY 335	W6SHY 334	YV1KZ 333	K2JF 329	DK5WQ 327	WW1N 322	WA5MLT 310	OA4EI 292	
VE3XN 335	W5RUK 334	YV1AJ 332	ZL1AGO 329	UY5XE 327	W6OUL 322	XE2LV 310	K7ZM 292	
4Z4DX 335	K4CN 334	KSØZ 332	W9OKL 329	KE5K 327	N3RX 321	XE2NLD 310	K1RB 292	

RTTY

K2ENT 333	K3UA 328	EA5FKI 320	W2JGR 316	OK1MP 312	KE5PO 297	I2EOW 291	W4QB 280	YC2OK 280
WB4UBD 330	NI4H 325	N5FG 318	G4BWP 312	PA5PQ 311	W4EEU 297	I1JQJ 289		

azine. Many of the "staffers" and those associated with *CQ* used the call from their home stations across the country signing WW2CQ/6 (call area of operation). I was on signing WW2CQ/64, indicating that I am in the 4th U.S. call area. Logs have been sent to CQ headquarters and a nice QSL card will be sent to anyone who is in those logs.

Ham Gatherings

The hamfest season is about to start up here in the states. The big event in Charlotte, North Carolina will feature a DX dinner sponsored by the Carolina DX Association. This group includes some of those "big guns" from the east coast of the U.S. If you are able to attend this event, it's well worth your time. There is usually a good DX forum, and the fellowship enjoyed by this group will long be remembered.

A number of other events are coming up, too: the International DX Convention in Visalia, California; the Dayton HamVention®; Ham-Com in Dallas, Texas; and let's not for-

(Left to right) Don, K9UQN, is awarded the W9-DXCC's "Hog of the Year" award by N9US. (Photo courtesy of Bill, W9VA)

QSL Information

UA3QJC/V via RW6HS
UEØL via UAØMF
UE1AAA/P via UA1ANA
UE1NIV via UA1NDX
UE1RDA via UA1RJ
UE1RDA/1 via UA1RJ
UE1RDA/A via UA1RJ
UE1RDA/P via UA1RJ
UE1SSD via UA1RJ
UE1SSD/3 via UA1RJ
UE3EDA/3 via RZ3EC
UE3MFU via RK3MWI
UE3SDA via RU3SD
UE4HFC/P via RW4HO
UE4LKW via UA4LCH
UE4LPR via UA4LCH
UE4NKI/P via RW4NW
UE4NNU/P via UA4NU
UE6EWX via RW6HKF
UE6MAS via UA6MC
UE6YFF via RA6YJ
UE6YYW via UA6YW
UI8BAA via RW3VM
UK/JI2MED via JI2MED
UK8BAA via RW3VM
UM9M via UK8AR
UN9PW via UN5PR
UO6P via UN7PBY
UP1G via W7BO
UP59BF via UN7BF
UP9L via RW6HS
US4IXQ via WB7QXU
UT7UZZ/P via UT3UZ
UWØMF via UAØMF
UW2F via UTØFT
UW5Q via UR3QCW
UW8M via UR5MID
UZ8M via USØMR
V2/AA6TT via NT1Y
V25J via JA1ADT
V26AGO via JA7AGO
V31DK via KØZV
V31FG/P via DL2SWW
V63ZF via DK2ZF
V73B via N6AWD
V73T via N6AWD
V73ZF via DK2ZF
VE2/VE3E via VE3EXY
VE7KVL via VA7DP
VI3JA via VK3JA
VK4ANS/LH via ZL1AMO
VK4FW/P via VK4FW
VK8AV via UA9XC
VK9AB via ZL1AMO
VK9LB via DL7AFS
VO2/AB5E via N6AWD
VO2/AD5A via N6AWD
VP2EYC via DJ6YC
VP5/K4IS via N2AU
VP6HI via ZL1AMO
VP6RW via ZL1AMO
VQ9CJ via N5JED
VQ9JC via ND9M
VR2CMX via JN4ASA
VU3LCA via CT1CTZ
VYØCQ via VE3ZCO
W2H via W2HC
W4V via W4DAI
W5D via W5GAD
WH6CZC/KHØ via JF1UMK
WK3D/AHØ via JF2MBF
WL7E/WZ6 via WL7E
WW2DDM via K4BSF
X7AA via S7KC
XE2AUB via EA5OL
XF1/F6AOI/XF3 via F6AOI
XF1DN via N6AWD
XF1K via N6AWD
XQ3BRN via IZ6BRN
XR2F via NK4U
XU7TZG via ON4AJV
XX9TST via VR2ZST
YAØY via DL5SE
YA1AB pirate
YA6Y via DG3ACF
YBØAJR/4 via OK1JR
YC4VD via LZ1YE
YE1P via YB1TC
YI1UNH via WA3HUP
YI6IB pirate
YI9CG pirate
YI9KT via SP8HKT
YI9WRV via W3HNK
YJØARW via ZL1AMO
YJ8RW via ZL1AMO
YK2MM pirate
YL1S via YL1ZS
YS3SU via TI4SU
YT200S via 4N1RS
YT5A via YT1AD
YV1/K3UO via W1AF
YV1/W5ALT via W5ALT
YW6C via W4SO
YZ200A via YZ1AA
YZ80A via YZ1AA
Z21HL via G8VHB
Z22JD via K3PD
ZA/OH2BH via OH2BH
ZA/OH2PM via OH2PM
ZA1DX via OH2BH
ZB2/ON4CJK via ON4ADN
ZB2/ON5FP via ON4ADN
ZK1CQ via ZL1AMO
ZK1MB via ZL1AMO
ZK2EA via ZL1AMO
ZK2RW via ZL1AMO
ZK2WW via K6DXX
ZK2ZZ via K6DXX
ZK3RW via ZL1AMO
ZK9RW via ZL1AMO
ZLØAFZ/9 via ZL1AMO
ZL150A via ZL1AMO
ZL1AMO/C via ZL1AMO
ZL1CQ via ZL1AMO
ZL7AMO via ZL1AMO
ZL8AMO via ZL1AMO
ZL9/ZLØAFZ via ZL1AMO
ZL9AMO via ZL1AMO
ZM1A via ZL1AMO
ZM7AMO via ZL1AMO
ZM8CW via ZL1AMO
ZS1CT via ZS1ACH
ZT6T via ZS6MG
ZV10AS via PY2DBU
ZW10AS via PT2ADM
ZW7AA via PS7KC
ZX7AA via PS7KC
ZY10AS via PY2KQ

(The table of QSL Managers is courtesy of John Shelton, K1XN, editor of "The Go List," 106 Dogwood Dr., Paris, TN 38242; phone 731-641-4354; e-mail: <golist@golist.net>.)

Dany, F5CW, operates as 6W1RV from Senegal resort in the CQ WW contest. (Photo courtesy of Dany, F5CW)

get the W9-DXCC Convention in September. Perhaps we'll run into you at one of these events this year.

And Finally . . .

Here's a bit of trivia for you: I'm sure that at one time or another most of you have listened to WWV to set your clocks, etc. The voice you heard belonged to Marty Edwards, who died on December 10th. Marty was a newscaster who doubled as the voice of WWV. He did the speech transcripts for the time checks provided by the U.S. Navy Bureau of Standards and broadcast on WWV from Fort Collins, Colorado.

Until next time, I hope you worked at least some of the DXpeditions that have been active recently. 73, Carl, N4AA

We're WAKING UP DXING!

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BY TOMAS HOOD,* NW7US

More Solar Surprises
Unexpected Flares in December and January

A Quick Look at Current Cycle 23 Conditions

(Data rounded to nearest whole number)

Sunspots
Observed Monthly, December 2004: 18
Twelve-month smoothed, June 2004: 42

10.7 cm Flux
Observed Monthly, December 2004: 95
Twelve-month smoothed, June 2004: 107

***Ap* Index**
Observed Monthly, December 2004: 11
Twelve-month smoothed, June 2004: 14

It is very interesting how shortwave conditions can become so degraded as to thwart the best-laid plans of dedicated communicators. Volunteers who dedicate themselves to the pursuit of emergency HF communications support sometimes find themselves struggling to accomplish the mission at hand when shortwave frequencies become unstable and unreliable.

I am the US Army MARS State MARS Director (SMD) of Washington State. We have occasional emergency exercises during which we establish command and control nets as well as traffic nets. These nets cover the state of Washington as well as the northwestern area of the lower 48 continental states.

We had such an exercise during the last days of December 2004. We chose the last Wednesday and Thursday of the year based on the 27-day solar cycle rotation, which gave us a potential window of opportunity for reasonably good propagation in our region. The prediction was that since the expected *Ap*-index would be the lowest during those two days, we could expect solid communications on the frequencies we engineered for this net communication.

Alas, the best-laid plans of mice and men don't sway the chaos of the nearest star. The sun became active with a series of M-class flares. These flares occurred right at the time of each of our scheduled nets! Add to this the solar wind that increased in speed and density. This caused the geomagnetic field to become active, causing degradation of HF NVIS propagation. We really struggled with establishing a reliable link between stations. It goes to show you that the sun may not always follow the 27-day rotation cycle used to forecast conditions, especially during periods of the 11-year solar cycle when the sun is undergoing radical changes.

The Shedding of Skin

As we move closer and closer to the period of minimum solar activity, the sun continues to throw off its complex magnetic structures. It is typical of all solar cycles we've observed that the decline will see short periods of strong, energetic flares with associated coronal mass ejections (CMEs), as well as long-lasting coronal holes, and then longer periods of relative quiet.

By studying the vast amount of raw data gathered by Solar and Heliospheric Observatory (SOHO) spacecraft, scientists have discovered a process by which the sun reverses its magnetic polarity and sheds complex magnetic structures.

The data has revealed that CMEs play a major role in the sun's magnetic pole swapping. This flipping is the cumulative effect of more than a thousand of these huge eruptions, which blast billions of tons of electrified gas into space. These CMEs carry away the sun's old magnetic field, allowing a new one with a flipped orientation to form. The last flip of the sun's polarity occurred during the peak of this cycle. The next flipping is expected perhaps in 2017. The sun will continue to "spin down" while expelling the remaining complex magnetic structures until it reaches a lull in activity. Then the sun will "spin up" and complex structures will begin to form once again.

Such CMEs are the source of recent occurrences of intense geomagnetic storms, such as the one in January 2005. These flare-ups come out of some very quiet periods, but they are normal. This is a sign that the sun is continuing to get rid of the current complex magnetic structures as it starts to form new ones with the reversed orientation.

Since the sun's magnetic field permeates the entire solar system, and beyond (in a region called the *heliosphere*), it interacts with the Earth and Earth's magnetic field (a field known as the *magnetosphere*). The sun's huge magnetic field is

*P.O. Box 213, Brinnon, WA 98320-0213
e-mail: <cq-prop-man@hfradio.org>

LAST-MINUTE FORECAST

Day-to-Day Conditions Expected for March 2005

	Expected Signal Quality			
Propagation Index.....	(4)	(3)	(2)	(1)
Above Normal: 2, 5-6, 15-16, 18-19, 23, 29	A	A	B	C
High Normal: 7, 9-10, 12-24, 17, 20-22, 24	A	B	C	C-D
Low Normal: 1, 11, 26-28	B	C-B	C-D	D-E
Below Normal: 4, 8, 25, 31	C	C-D	D-E	E
Disturbed: 3, 30	C-D	D	E	E

Where expected signal quality is:
A—Excellent opening, exceptionally strong, steady signals greater than S9.
B—Good opening, moderately strong signals varying between S6 and S9, with little fading or noise.
C—Fair opening, signals between moderately strong and weak, varying between S3 and S6, with some fading and noise.
D—Poor opening, with weak signals varying between S1 and S3, with considerable fading and noise.
E—No opening expected.

HOW TO USE THIS FORECAST

1. Find the *propagation index* associated with the particular path opening from the Propagation Charts appearing on the following pages.
2. With the *propagation index,* use the above table to find the expected signal quality associated with the path opening for any given day of the month. For example, an opening shown in the Propagation Charts with a *propagation index* of 3 will be fair to good (C-B) on March 1st, excellent (A) on the 2nd, poor (D) on the 3rd, etc.

Visit Our Web Site

HOW TO USE THE SHORT-SKIP CHARTS

1. In the Short-Skip Chart, the predicted times of openings can be found under the appropriate distance column of a particular meter band (10 through 160 meters) as shown in the left-hand column of the chart. For the Alaska and Hawaii Charts the predicted times of openings are found under the appropriate meter band column (15 through 80 meters) for a particular geographical region of the continental USA as shown in the left-hand column of the charts. An * indicates the best time to listen for 80 meter openings.

2. The propagation index is the number that appears in ( ) after the time of each predicted opening. On the Short-Skip Chart, where two numerals are shown within a single set of parentheses, the first applies to the shorter distance for which the forecast is made, and the second to the greater distance. The index indicates the number of days during the month on which the opening is expected to take place, as follows:

(4) Opening should occur on more than 22 days
(3) Opening should occur between 14 and 22 days
(2) Opening should occur between 7 and 13 days
(1) Opening should occur on less than 7 days

Refer to the "Last Minute Forecast" at the beginning of this column for the actual dates on which an opening with a specific propagation index is likely to occur, and the signal quality that can be expected.

3. Times shown in the charts are in the 24-hour system, where 00 is midnight; 12 is noon; 01 is 1 AM; 13 is 1 PM, etc. In the Short-Skip Chart appropriate *standard* time is used at the path midpoint. For example on a circuit between Maine and Florida, the time shown would be EST, on a circuit between New York and Texas, the time at the midpoint would be CST, etc. Times shown in the Hawaii Chart are in HST. To convert to standard time in other USA time zones add 2 hours in the PST zone; 3 hours in the MST zone; 4 hours in the CST zone; and 5 hours in the EST zone. Add 10 hours to convert from HST to GMT. For example, when it is 12 noon in Honolulu, it is 14 or 2 PM in Los Angeles; 17 or 5 PM in Washington, D.C.; and 22 GMT. Time shown in the Alaska Chart is given in GMT. To convert to *standard* time in other areas of the USA subtract 8 hours in the PST zone; 7 hours in the MST zone; 6 hours in the CST zone; and 5 hours in the EST zone. For example, at 20 GMT it is 15 or 3 PM in New York City.

4. The Short-Skip Chart is based upon a transmitted power of 75 watts CW or 300 watts PEP on sideband; the Alaska and Hawaii Charts are based upon a transmitter power of 250 watts CW or 1 KW PEP on sideband. A dipole antenna a quarter-wavelength above ground is assumed for 160 and 80 meters, a half-wave above ground on 40 and 20 meters, and a wavelength above ground on 15 and 10 meters. For each 10 dB gain above these reference levels, the *propagation index* will increase by one level; for each 10 dB loss, it will lower by one level.

5. Propagation data contained in the charts has been prepared from basic data published by the Institute for Telecommunication Sciences of the U.S. Dept. of Commerce, Boulder, Colorado 80302.

CQ Short-Skip Propagation Chart
March & April 2005
Band Openings Given In Local Standard Time At Path Mid-Point (24-Hour Time System)

Band (Meters)	*Distance From Transmitter (Miles)*			
	50-250	*250-750*	*750-1300*	*1300-2300*
10	Nil	Nil	08-19 (0-1)	08-13 (1-0) 13-16 (1) 16-19 (1-0)
15	Nil	08-16 (0-1)	09-12 (1) 12-17 (1-2) 17-18 (0-1)	08-09 (0-1) 09-10 (1) 10-13 (1-2) 13-14 (2) 14-17 (2-3) 17-18 (1-2) 18-20 (0-1)
20	Nil	07-08 (0-1) 08-09 (0-2) 09-14 (0-3) 14-16 (0-2) 16-23 (0-1)	07-08 (1) 08-09 (2) 09-10 (3) 10-14 (3-4) 14-16 (2-4) 16-18 (1-4) 18-19 (1-3) 19-20 (1-2) 20-23 (1) 23-05 (0-1)	06-07 (0-1) 07-08 (1-2) 08-09 (2-3) 09-10 (3) 10-15 (4-3) 15-18 (4) 18-19 (3) 19-20 (2-3) 20-21 (1-2) 21-05 (1) 05-06 (0-2)
40	07-09 (0-1) 09-10 (0-2)	06-07 (0-2) 07-09 (1-4)	06-07 (1) 07-08 (4-2) 10-12 (2-3) 12-17 (3-4) 17-19 (2-3) 19-20 (1-2) 20-22 (0-1)	06-08 (2-1) 08-15 (1-0) 09-10 (2-4) 10-15 (4-3) 15-17 (4) 17-19 (3-4) 19-20 (2-4) 20-22 (1-2) 22-00 (0-2) 00-06 (0-1)
80	07-08 (2-3) 08-11 (3-4) 11-18 (4) 18-20 (3-4) 20-22 (2-3) 22-00 (1-2) 00-06 (1) 06-07 (1-2)	07-08 (3-2) 08-11 (4-1) 11-16 (4-0) 16-18 (4-2) 18-20 (4-3) 20-22 (3-4) 22-00 (2-4) 00-06 (1-2) 06-07 (2)	07-08 (2-1) 08-11 (1-0) 11-16 (0) 16-18 (2-1) 18-20 (3-2) 20-00 (4) 00-05 (2-3) 05-07 (2)	07-08 (1-0) 08-16 (0) 16-18 (1-0) 18-20 (2-1) 20-22 (4-2) 22-00 (4-3) 00-05 (3) 05-07 (2-1)
160	05-07 (4-2) 07-09 (3-1) 09-17 (2-0) 17-19 (3-1) 19-20 (4-2) 20-05 (4)	05-06 (2-1) 06-07 (2-0) 07-09 (1-0) 09-17 (0) 17-19 (1-0) 19-20 (2) 20-22 (4-3) 22-03 (4) 03-05 (4-3)	05-06 (1) 06-19 (0) 19-20 (2-1) 20-22 (3-2) 22-03 (4-3) 03-05 (3-2)	05-06 (0-1) 06-19 (0) 19-20 (1-0) 20-22 (2) 22-03 (3-2) 03-05 (2-1)

ALASKA
Openings Given in GMT

To:	*10 Meters*	*15 Meters*	*20 Meters*	*40/80 Meters*
Eastern USA	Nil	22-00 (1)	22-00 (1) 00-02 (2) 02-04 (1)	06-13 (1) 07-12 (1)*
Central USA	Nil	20-22 (1) 22-00 (2) 00-01 (1)	22-00 (1) 00-03 (2) 03-05 (1)	07-09 (1) 09-12 (2) 12-14 (1) 07-12 (1)*
Western USA	Nil	20-22 (1) 22-00 (2) 00-03 (1)	19-22 (1) 22-00 (2) 00-02 (3) 02-04 (2) 04-06 (1)	06-08 (1) 08-09 (2) 09-12 (3) 12-13 (2) 13-15 (1) 08-10 (1)* 10-12 (2)* 12-14 (1)*

HAWAII
Openings Given in Hawaiian Standard Time

To:	*10 Meters*	*15 Meters*	*20 Meters*	*40/80 Meters*
Eastern USA	Nil	08-11 (1) 11-13 (2) 13-14 (3) 14-15 (2) 15-16 (1)	02-05 (1) 05-07 (2) 07-13 (1) 13-15 (2) 15-17 (3) 17-19 (2) 19-21 (1)	18-19 (1) 19-21 (2) 21-00 (3) 00-02 (2) 02-03 (1) 19-21 (1)* 21-00 (2)* 00-02 (1)*
Central USA	11-15 (1)	08-09 (1) 09-13 (2) 13-15 (3) 15-16 (2) 16-17 (1)	03-05 (1) 05-08 (2) 08-13 (1) 13-15 (2) 15-16 (3) 16-18 (4) 18-19 (3) 19-21 (2) 21-23 (1)	18-19 (1) 19-21 (2) 21-01 (3) 01-04 (2) 04-05 (1) 19-21 (1)* 21-01 (3)* 01-02 (2)* 02-03 (1)*
Western USA	11-15 (1)	08-09 (1) 09-10 (2) 10-12 (3) 12-15 (4) 15-16 (3) 16-17 (2) 17-18 (1)	02-04 (1) 04-06 (2) 06-09 (4) 09-11 (3) 11-13 (2) 13-15 (3) 15-17 (4) 17-19 (3) 19-21 (2) 21-23 (1)	17-19 (1) 19-20 (2) 20-23 (4) 23-05 (3) 05-06 (2) 06-07 (1) 19-20 (1)* 20-21 (2)* 21-04 (3)* 04-05 (2)* 05-06 (1)*

**Indicates best times to listen for 80 meter openings. Openings on 160 meters are also likely to occur during those times when 80 meter openings are shown with a propagation index of (2) or higher.*
For 12 meter openings interpolate between 10 and 15 meter openings.
For 17 meter openings interpolate between 15 and 20 meter openings.
For 30 meter openings interpolate between 40 and 20 meter openings.

Propagation charts prepared by George Jacobs, W3ASK.

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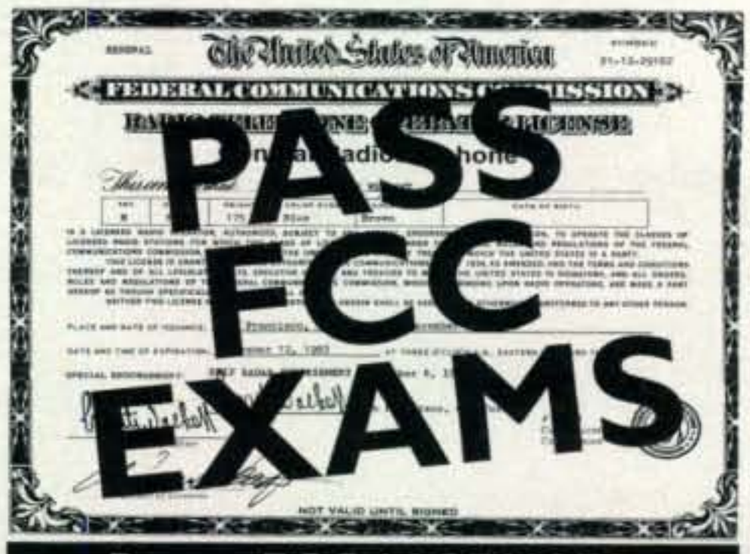

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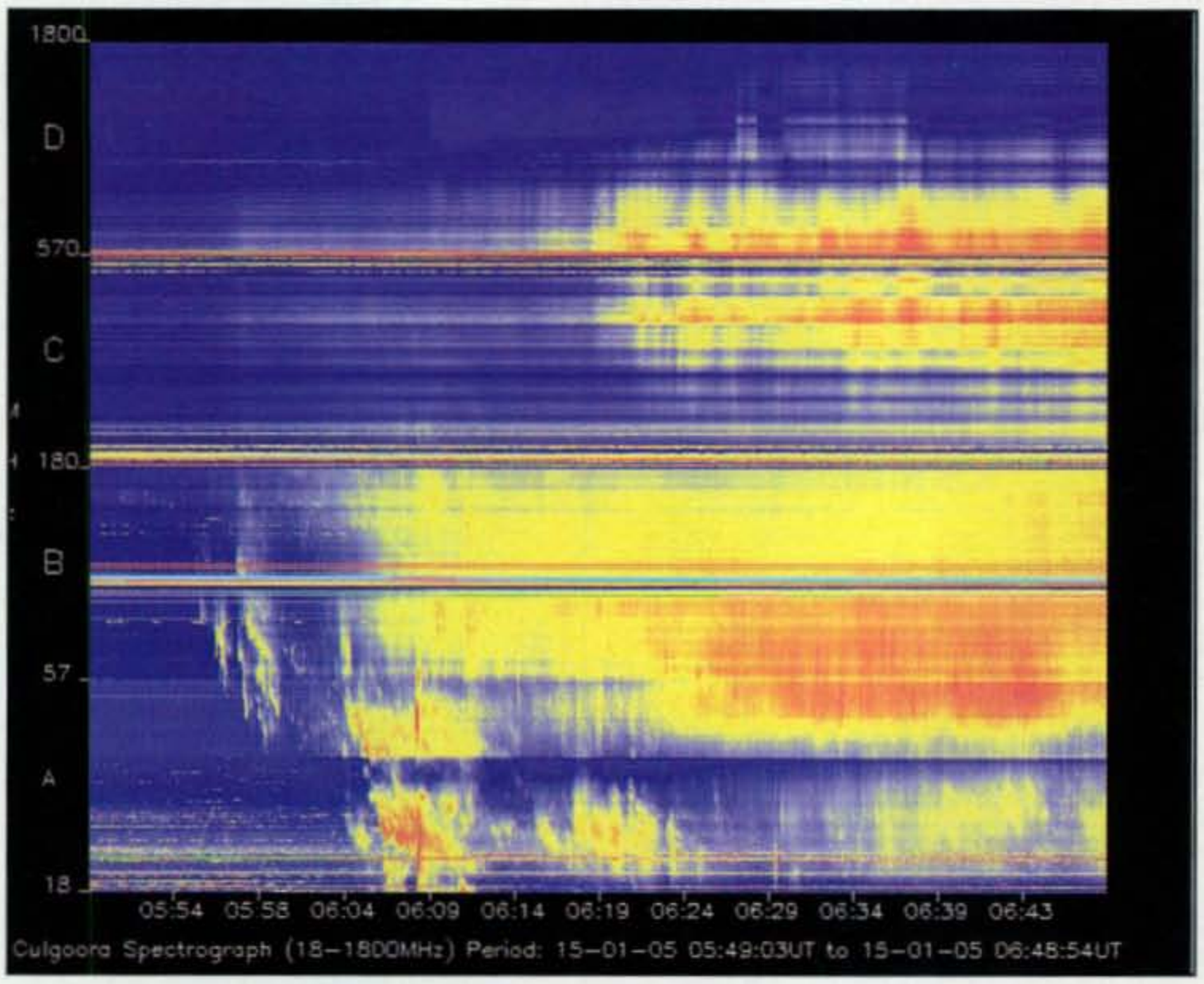

Fig. 1– This image is a record of radio signal detection between 18 MHz and 1800 MHz. It shows the extremely strong Type IV event followed the Type II event of January 15, 2005, associated with the M8.6 flare. (Source: IPS, Australia)

called the *Interplanetary Magnetic Field* (*IMF*) and is a primary cause of space weather. Sprawling out away from the sun is a solar wind that rides the IMF.

As Earth orbits the sun, it dips in and out of the wavy current sheet of the IMF. On one side, the sun's magnetic field points north, or toward the sun. On the other side, it points south, or away from the sun. The IMF's orientation is indicated by the *Bz* index. When the *Bz* is negative, it indicates a southerly oriented IMF; when positive, it indicates a northerly oriented IMF.

South-pointing solar magnetic fields tend to "magnetically reconnect" with Earth's own magnetic field. This allows the solar wind, and the plasma, to flow in and collect in a reservoir known as the *boundary layer*. The energetic particles riding the solar wind can then penetrate the atmosphere, causing aurora and triggering geomagnetic storms.

If the IMF is oriented northward, however, this magnetic reconnection does not take always take place. Yet if the pressure of the shock wave from a passing CME is great enough, even with the IMF oriented northward, the geomagnetic field will become highly active.

When the IMF connects with the magnetic field around the Earth, and as solar-wind plasma flows into the atmosphere, the geomagnetic field lines become highly active. This is known as a geomagnetic storm.

Geomagnetic storms cause a degradation of radio-signal propagation as a result of ionospheric recombination. This recombination is similar to what takes place during the hours of darkness, with a lowering of the frequencies each ionospheric layer can refract. Geomagnetic storms can cause long-term (hours to days) degradation, or depression, of the maximum usable frequencies (MUFs), reducing the critical frequencies by as much as 50 percent of normal.

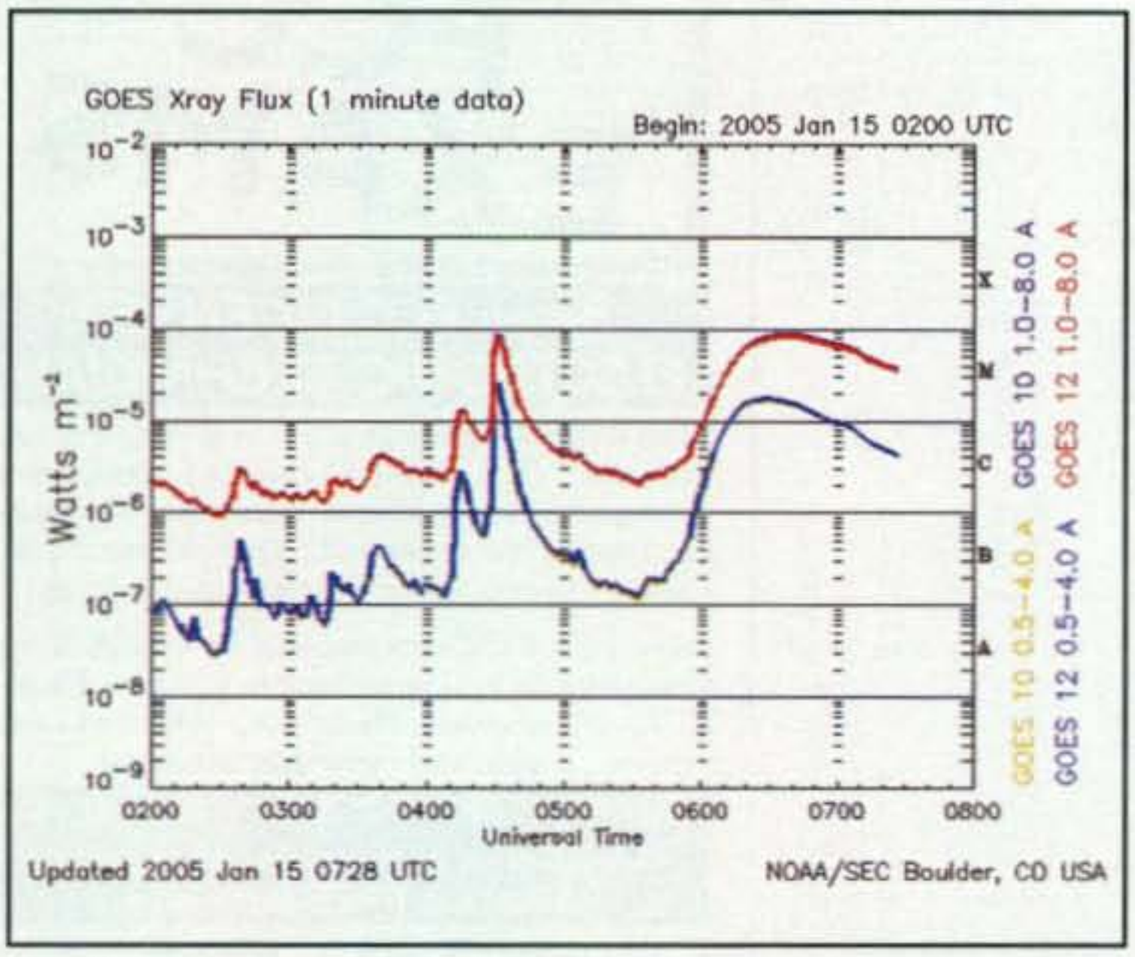

Fig. 2–The GEOS satellite X-ray flux record showing the long-duration flare that measured M8.6 at 0638 UTC on January 15, 2005. Note the first M-class flare on this graph. It explodes to peak intensity rather quickly and decays fairly rapidly. This is what we often see. The M8.6 flare, however, was much slower in reaching its peak, and it took a while for it to subside. (Source: NOAA/SEC)

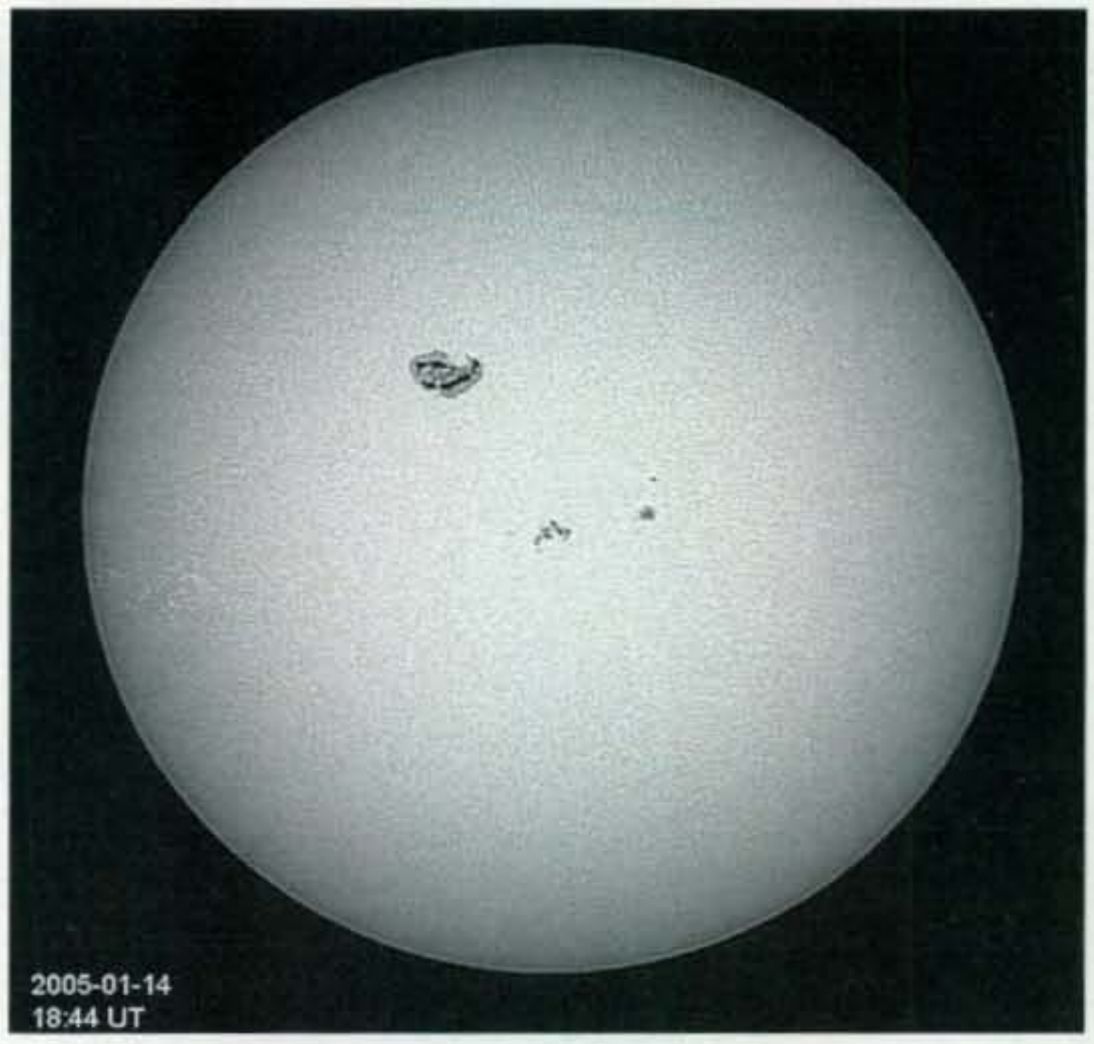

Fig. 3– The solar disk on January 14. Note the largest sunspot group. This is the active sunspot region numbered by NOAA as 10720. This is the sunspot group that unleashed powerful flares and coronal mass ejections, triggering severe geomagnetic storms by January 17. (Source: NOAA/SEC)

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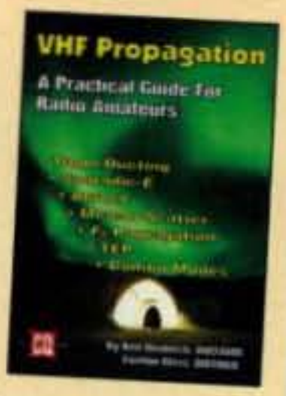

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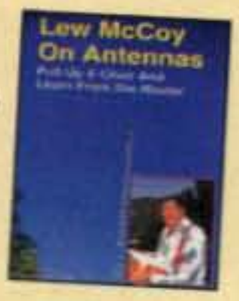

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Fig. 4– The active solar region 10720 on January 18 after unleashing three massive CMEs. Note that it is still nearly the same size as was observed on January 14. The region is moving out of a position where it can have a direct influence on Earth's space weather. Will it last long enough to make it around a full 27-day rotation? (Source: NASA/SEC)

January's Geomagnetic Storms and Giant Sunspot Group

On January 14, 2005 a sunspot developed on the Earth-facing side of the sun. NOAA numbered the sunspot as 10720, or simply as active region 720. It quickly grew to about seven times the size of Earth. It also quickly developed a complex magnetic structure capable of strong flaring activity. Sure enough, by the end of the first day of its existence, it unleashed 33 flares! Four of them were M-class flares.

By the second day of its existence, the flares intensified. The first flare of January 15 peaked at 0043 UTC at a level of X1.2, less than an hour into the new day. Shortly thereafter, the flares continued at fast succession. However, the most spectacular events were three long-duration flares.

Most flares tend to be very quick explosions, the total flare time lasting maybe up to an hour at most. They are sudden, powerful explosions, punching through the corona (a layer of the sun's atmosphere), possibly causing a portion of the corona to be blown away into interplanetary space (we call this a CME).

At 0554 UTC on January 15 a strong solar flare erupted that peaked at a level of M8.6 at 0638 UTC and caused a radio sweep event. The start time of this Type II radio burst was 0554 UTC with a mean shock speed estimated at 1300 kilometers per second. An extremely strong Type IV event followed the Type II event (see fig. 1). This indicated that the flare blew away a full-halo CME (one which is headed directly toward Earth). A minor proton event was also spawned from this flare event. Energetic solar proton events adversely impact transpolar HF propagation circuits.

At the same time, we were still experiencing the influence of a coronal hole, with somewhat elevated solar wind speeds averaging around 550 km/s. This had caused the geomagnetic field to be consistently active. I predicted that the arrival of the CME from this flare would push the geomagnetic activity to minor storm levels sometime on January 16 or 17.

The sun then surprised us again. The active sunspot region continued to keep its complex magnetic structure and did not decrease at all in size. Three more M-class flares were unleashed, as were numerous smaller flares. Then, at 2225 UTC January 15 this sunspot group birthed a long-duration X2.6 level flare!

This was the strongest of the flares so far unleashed, peaking at 2302 UTC. A Type II radio burst was detected, and this enhanced an already active proton event. A very fast coro-

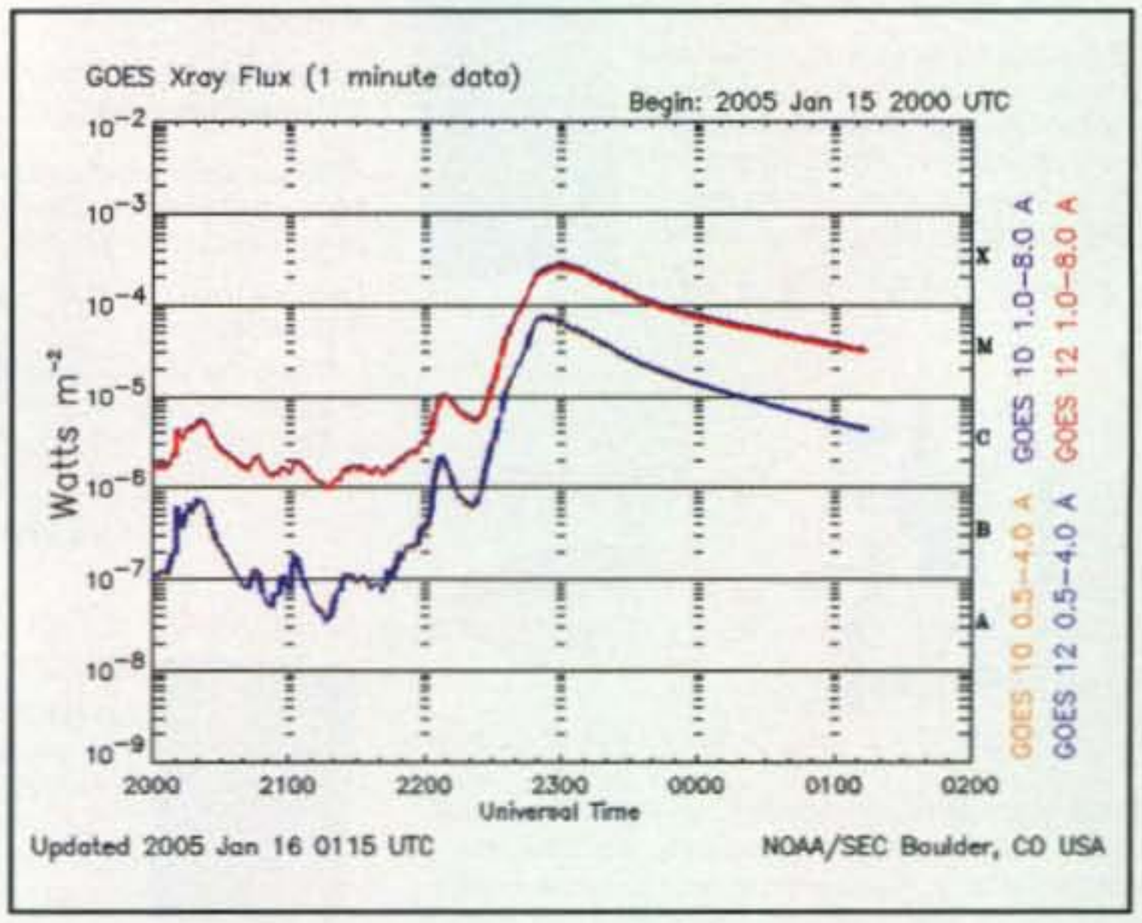

Fig. 5– The X2.6 long-duration flare of January 15, the second flare from sunspot region 10720 that unleashed a coronal mass ejection. Note again the slow decay after the peak. (Source: NASA/SEC)

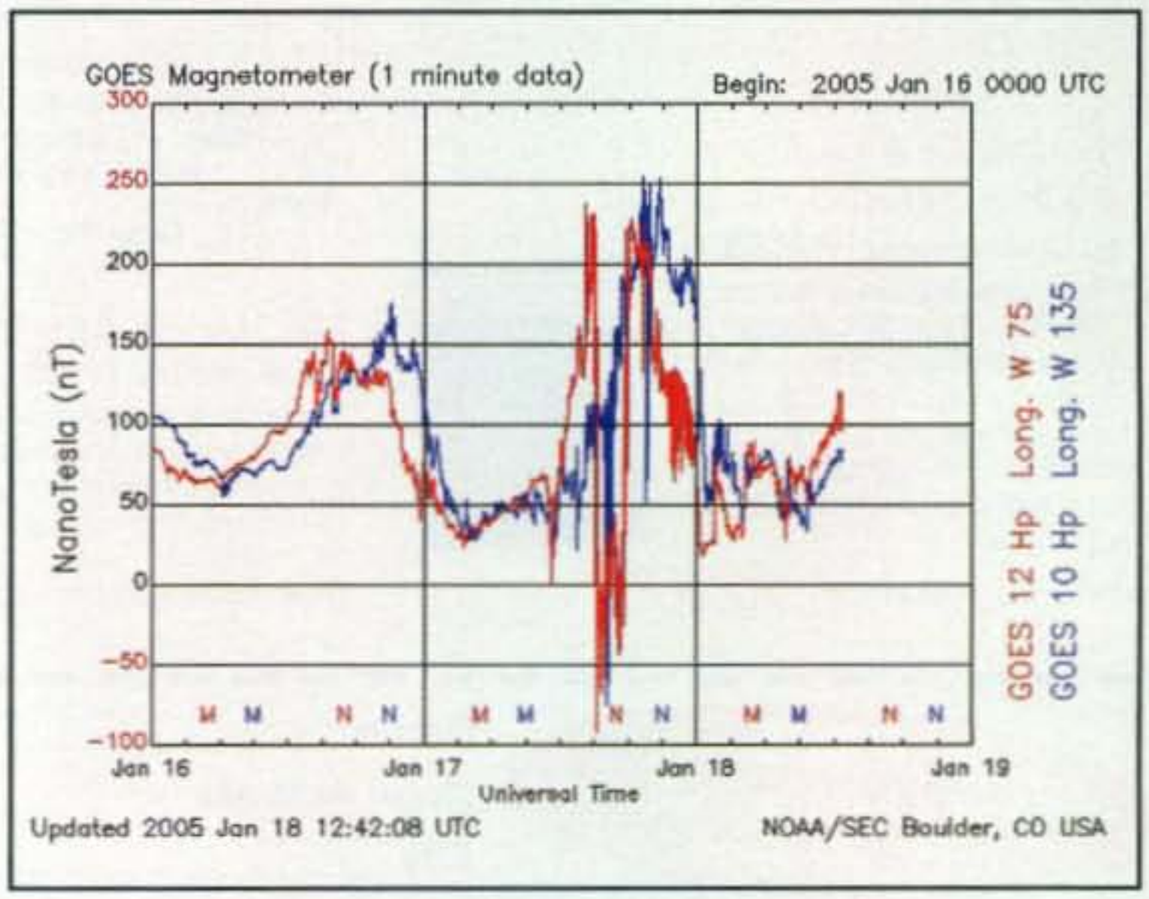

Fig. 6– GEOS satellite magnetometer readings that illustrate the shock wave from a CME arriving at the magnetosphere. During the later part of January 17 you can see the nT (nanoTeslas) dip strongly to nearly –100 nT. This indicates that the solar wind has compressed the magnetosphere well toward the Earth, moving it behind the satellite. This event shows a very strong and rapid compression and decompression of the magnetosphere, which in turn triggered strong to severe geomagnetic storms. (Source: NOAA/SEC)

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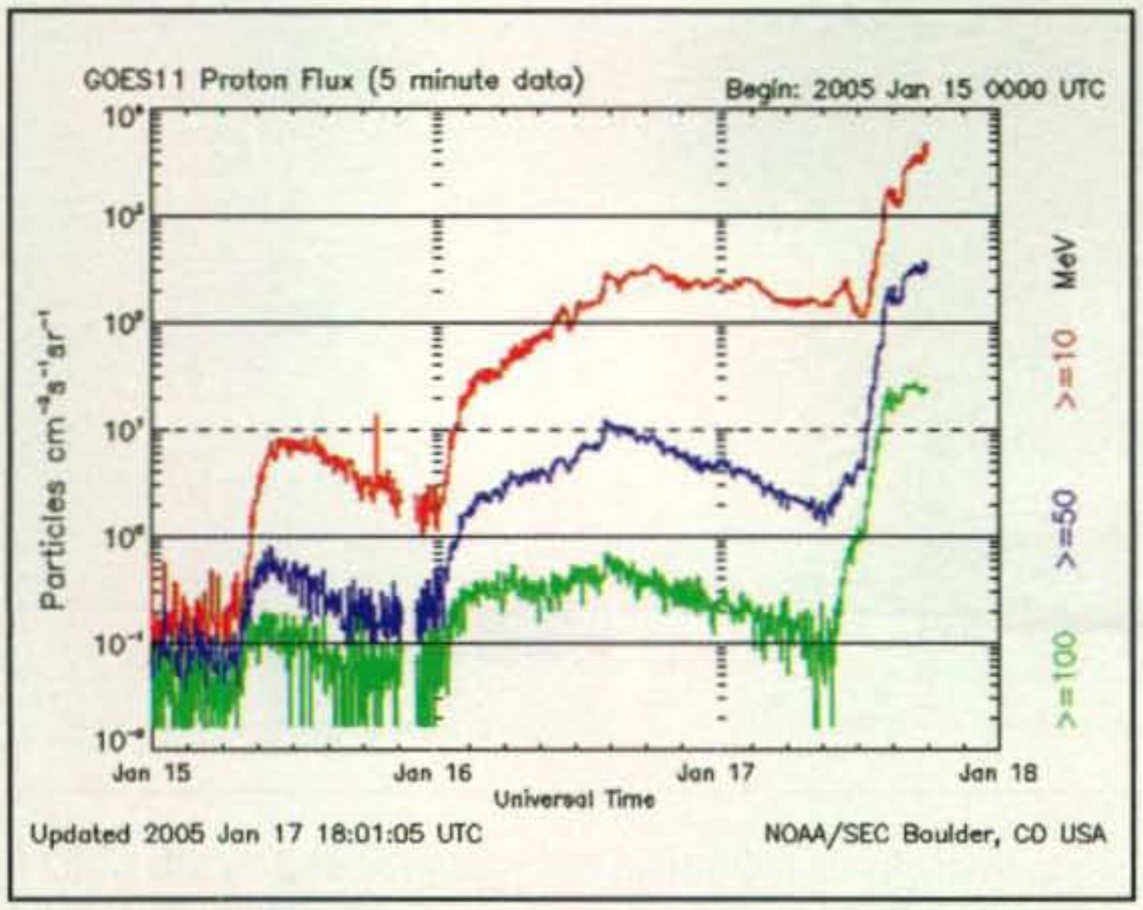

Fig. 7– This graph shows the first proton storm event, starting during the middle of January 15. Shortly after the beginning of January 16, you can see the result of the second big flare. The period between the beginning of January 16 through the middle of January 17 is the continued proton storm. Then, during the middle of January 17, the extreme proton storm began as a result of the X3.8 level flare on the 17th. Proton storms cause radio-path degradation, especially over the polar regions. (Source: NOAA/SEC)

nal mass ejection was associated with this X2.6 flare, with a shock speed estimated about 400 km/s faster than the first one of the day. I expected this CME to plough into our magnetosphere sometime on January 17 or 18, riding on the heels of the CME from the M-class long-duration flare from earlier. It seemed likely that a major geomagnetic storm would develop and be prolonged through the whole weekend.

During the course of these two days, the solar activity had risen significantly as a result of the active solar regions. The

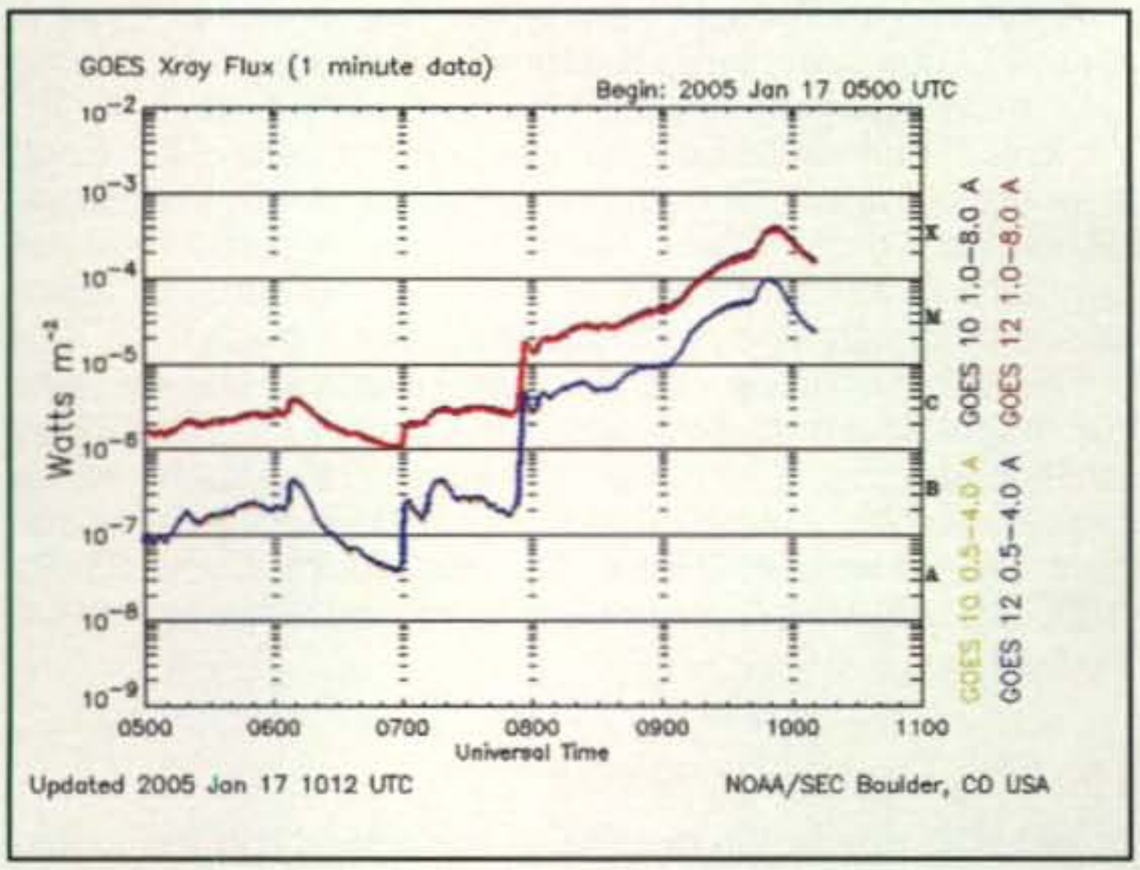

Fig. 8– The X3.8 (X4.1) level flare from active region 10720 that unleashed an extreme proton event and ejected a massive CME toward Earth on the 17th. Note the very long rise time of nearly two hours. The decay was equally long. (Source: NOAA/SEC)

10.7-cm flux reached 145, giving life to even 10 meters. However, with the expected geomagnetic storm levels anticipated from the arrival of two CMEs, the prognosis was for limited higher frequency propagation. Of course, aurora was a sure bet.

The first CME, associated with the long-duration M8.6-class flare of January 15 (0639 UTC), appeared to have arrived at around 0930 UTC January 16, when we saw the planetary *K*-index (*Kp*) reach 5 and the solar wind speed increase with a change in the interplanetary magnetic field.

The second CME associated with the X2.6-class X-ray flare of 2302 UTC January 15 arrived at 0640 UTC on January 16, detected as an energetic ion enhancement. The second indication of its arrival was a moderate shock reported at 0716 UTC by ACE.

The second CME pushed the solar wind speed to above 600 kilometers per second. The IMF became southward-oriented for short periods of time. This triggered active to minor storm geomagnetic activity during most of the day.

However, amazingly, by 0930 UTC it was clear that we were in the middle of another very long-duration X-class flare. The rise-time of this flare event lasted for nearly two hours!

By 1000 UTC the entire HF spectrum was shut down over the southern part of Africa (the area directly under the sun). Recovery time was expected to be 1 1/2 hours.

The flare from region 720 peaked at X3.8, while the solar wind speed remained above 600 km/s. It had a long decay as well, and unleashed an intense amount of plasma, proton, and energy burst. A very massive CME was detected with a shock speed of over 1500 km/s, more than 300 to 400 km/s faster than the last two CMEs!

The solar wind speed, due to the arrival of the second CME, exceeded 800 km/s, and the interplanetary magnetic field orientation was observed pointing southward. The geomagnetic field reached minor storm levels.

As the proton event hit from the X3.8 level flare, sensors onboard satellites became saturated with proton bombardment. We lost the data on solar wind speed, density, and the orientation of the IMF. For a long period after the start of this proton storm, we didn't really know how high the wind speed went, nor did we know how strong the IMF was oor its orientation. The proton event was very strong and lasted until January 19.

The arrival of the third CME was not easy to detect, since it occurred during the massive proton storm. Based on various ground-based magnetometer observations and other data, it has been deduced that the CME hit sometime around 1900 on January 18. This did not trigger a severe geomagnetic storm, but did cause enough to spawn visual aurora in high- and mid-latitude regions. By the middle of January 19, some magnetometer observations recorded *K*-indices as high as 9, although the estimated planetary *K*-index never rose past 7. Some VHF operators were able to work a small amount of aurora-mode propagation, but this period of geomagnetic activity never spawned the type of aurora such as was seen in November 2004.

Since the X3.8 flare of January 17, up to press time, active region 10720 unleashed three additional M-class flares (peaks at 1134 and 1549 UTC, 18-1-2005 and 1539 UTC, 19-1-2005), and two X-class flares (peaks at 0824 UTC, 19-1-2005, and 0659 UTC, 20-1-2005).

The X-class flare that peaked at 0824 UTC on January 19 caused another coronal mass ejection. This one, however, was directed somewhat to the side of the Earth, so only resulted in a glancing blow. Around 0300 UTC on January 20, the solar wind speed increased by over 200 km/s to about 800

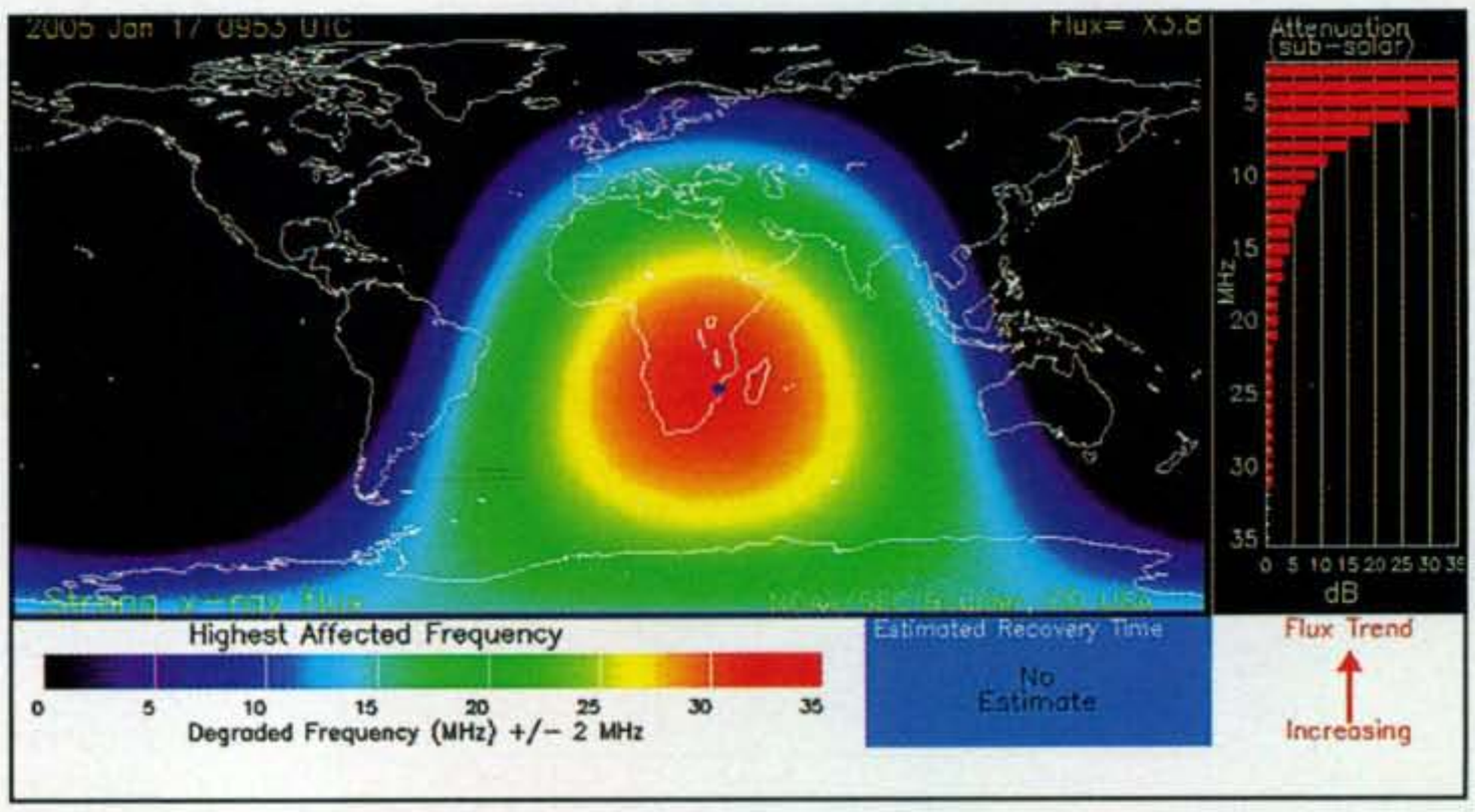

Fig. 9– This illustrates a radio blackout due to D-layer absorption. This image is from 0953 UTC January 17, right at the peak of the X3.8 level flare from active solar region 10720. Note the complete HF blackout over the southern part of Africa. (Source: NOAA/SEC)

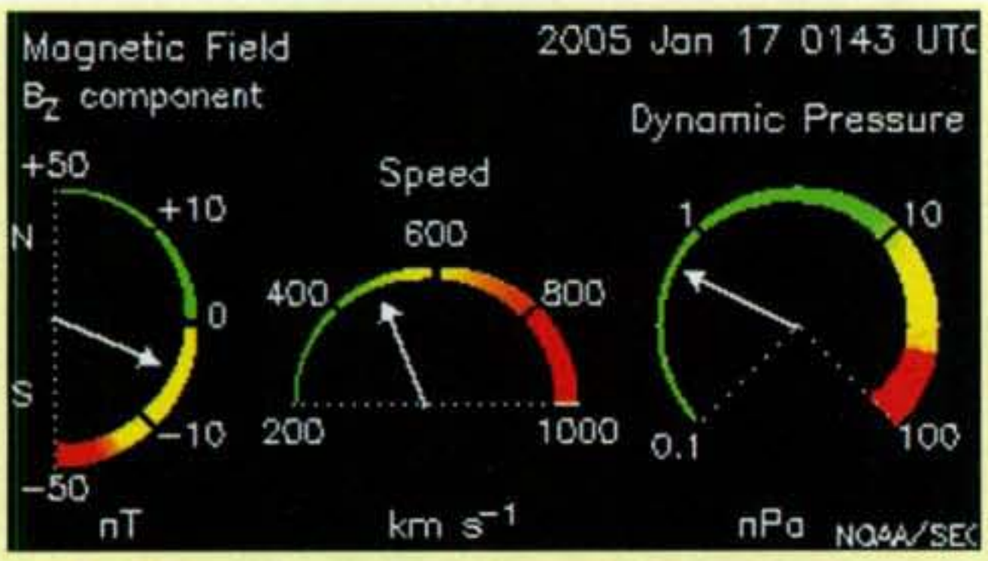

Fig. 10– The solar-wind dials just before the shockwave of the second major CME from active solar region 10720. (Source: NOAA/SEC)

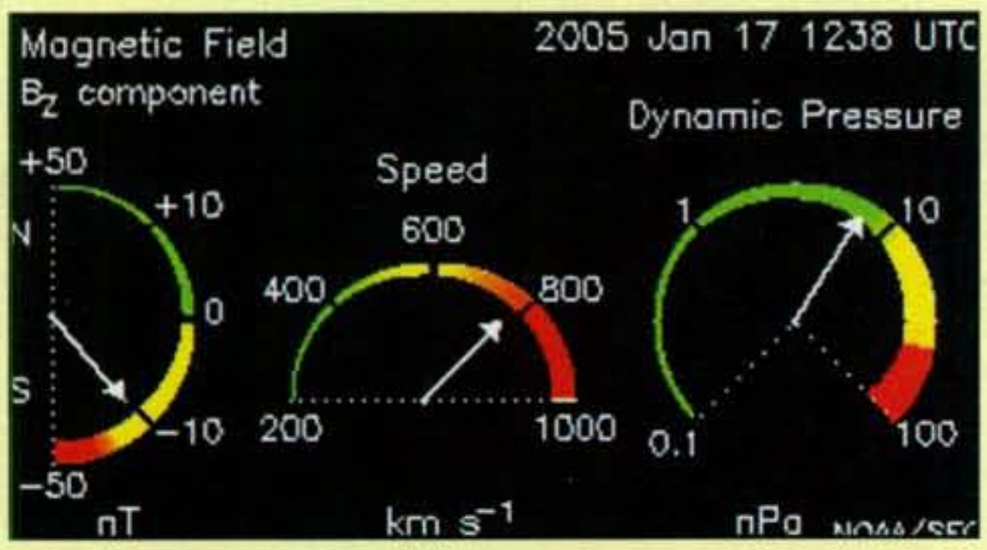

Fig. 11– The solar-wind dials showing a speed nearly 800 km/s with a strongly southward orientation in the interplanetary magnetic field (the "Bz" component). (Source: NOAA/SEC)

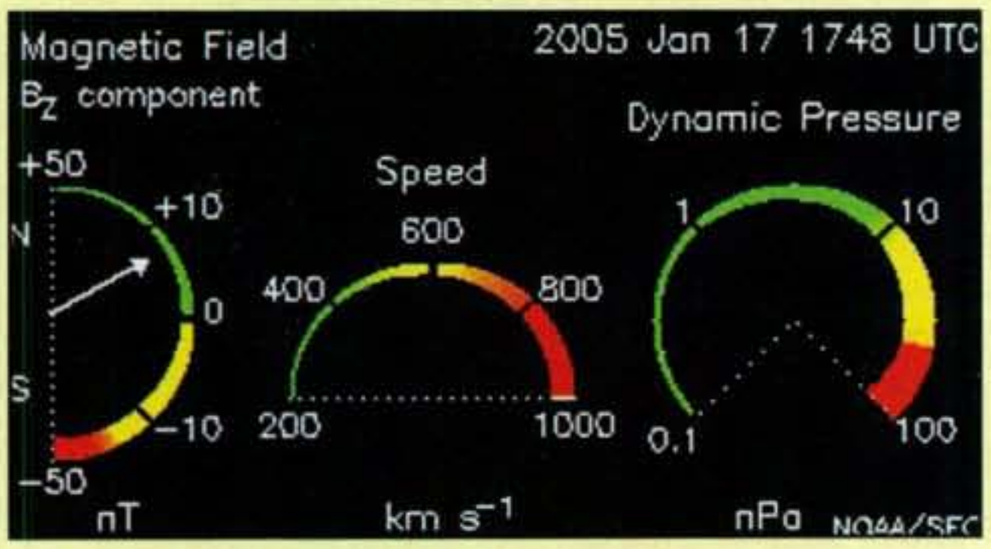

Fig. 12– The solar-wind dials after the sensors were saturated with protons from the extreme proton storm of January 17. There's no way at this point to know what the solar wind is doing. (Source: NOAA/SEC)

km/s, then slowly increased in average speed, finally reaching over 900 km/s by 0700 UTC. The *Bz* remained mostly positive, so it did not create any significant geomagnetic response. Then, just after 0700 UTC, a very sudden and extremely intense proton event hit.

At 0636 UTC, a massive X7.1 level flare exploded in a spectacular fashion, creating a severe and sudden proton event that by 0700 UTC saturated the sensors aboard various satellites. Once again, it became impossible to monitor space weather in real-time. It is not known at press time whether or not this flare triggered a coronal mass ejection. If so, it probably will not cause significant geomagnetic activity, since it would be ejected out away from the Earth. At press time, region 10720 is near the edge of the solar disk, about to rotate off the visual side.

The X7.1 level flare is the *third* largest flare of this solar cycle. If this had directly faced Earth, it would have had a very significant impact. We now know that there was a full-halo CME from this flare. It is highly probable, but we don't have confirmation yet from the SOHO science team, that we *will* have a direct impact from this CME. If so, it could cause a significant event (geomagnetic storm, aurora, etc.) that might surpass all of the activity so far associated with this active solar region.

Active region 720 has been amazingly eventful. At press time, 17 large solar flares produced moderate (R2) to strong (R3) radio blackouts between January 14 and 20, 2005. HF radio communications on the sunlit hemisphere of the Earth experienced significant signal degradation during these solar flares. Four major CMEs have been blown away from the Sun, directly aimed at the Earth, causing long-duration degradation of ionospheric propagation of radio signals.

This sunspot group, and this level of activity and resulting geomagnetic storminess, was not expected in the 27-day rotation forecast. It is, however, expected that such intense periods of solar activity will flare up rather violently as the sun continues to wind down until the end of solar Cycle 23. By 2007, the sun will become nearly quiet, and these events will be rare.

HF Propagation in March

In general, due to the decline of the solar cycle the ionosphere is not able to support propagation on the higher HF frequencies. Also, with the reduced energy level of the ionosphere, bands such as 20 meters suffer with early closures, quickly becoming quiet after dark. Signals are generally weaker over many paths.

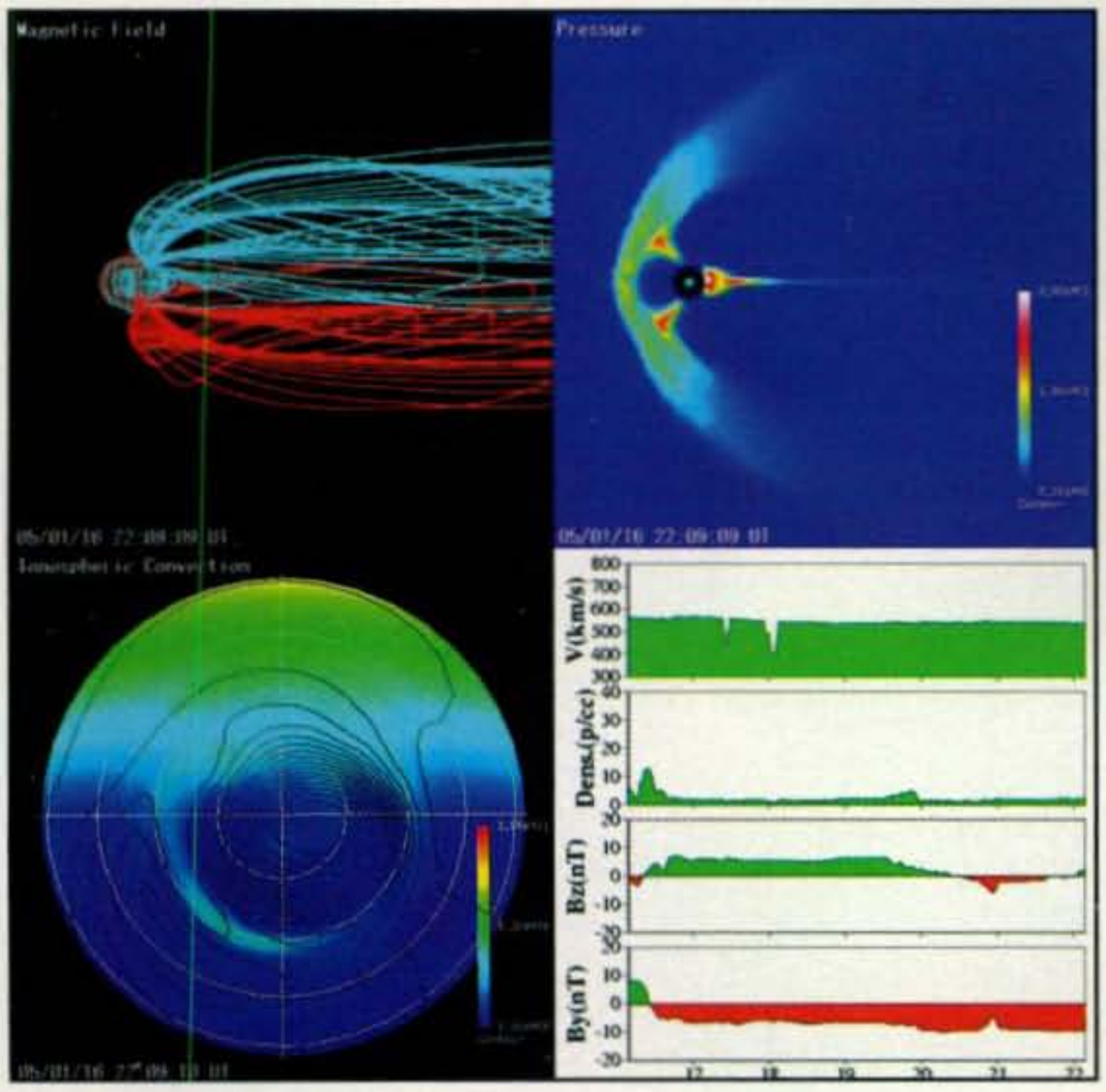

Fig. 13– Model of the magnetosphere under the influence of a moderate solar wind speed on January 16. The solar wind speed is about 550 km/s for an extended period. The Bz (orientation) barely goes negative (southward). The ionosphere is not experiencing too deep a depression due to recombination. (Source: Simulator Group, Applied Research and Standards Division/Communications Research Laboratory/Koganei, Tokyo)

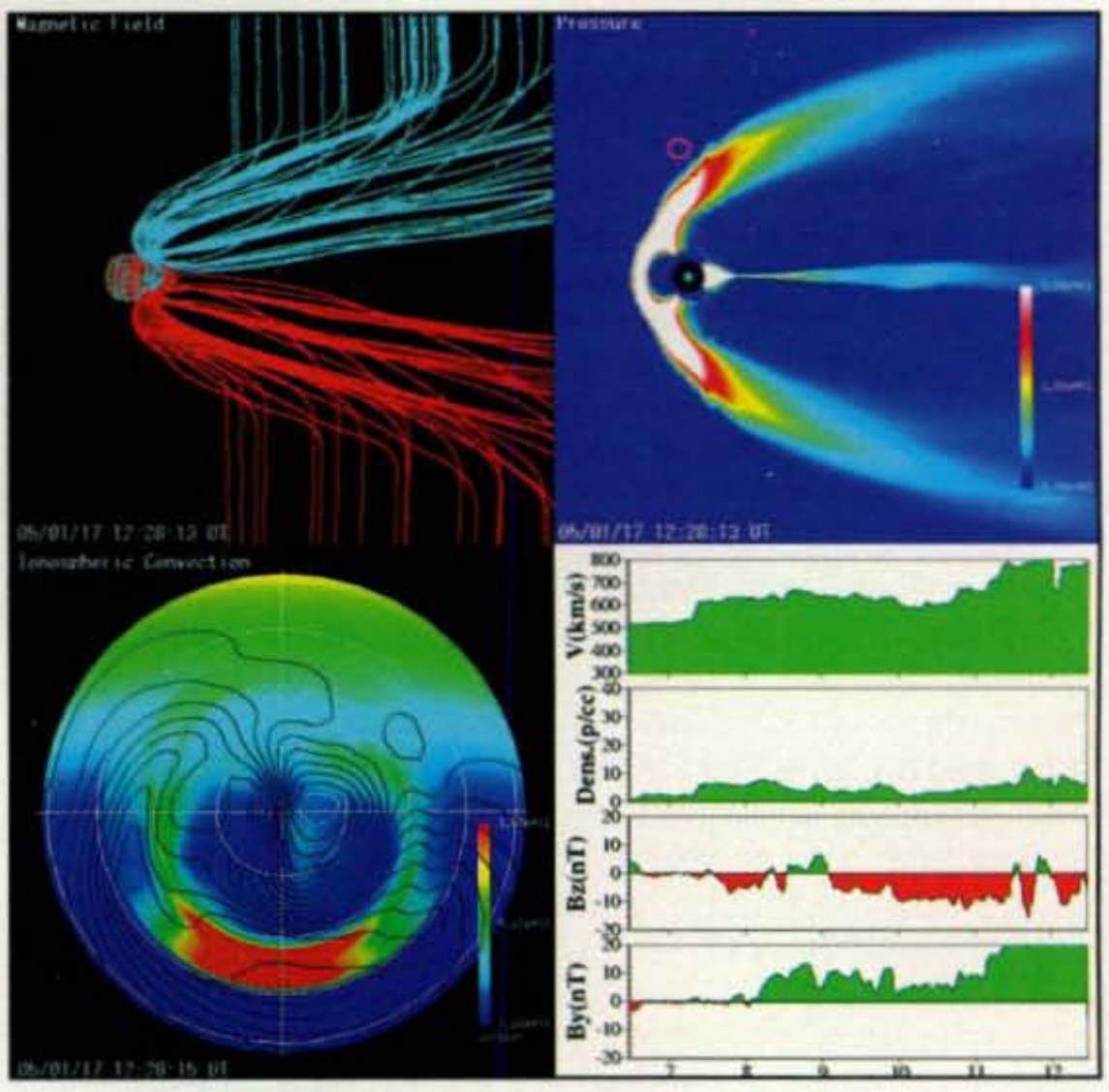

Fig. 14– The same model as in fig.13, but after the shockwave where the solar wind speed is at least 800 km/s and the Bz has gone negative. Notice how the magnetosphere reacts, and the ionospheric convection is significant. This illustrates the shockwave's power to compress and alter the magnetosphere, influencing the ionosphere, which in turn degrades HF communication. (Source: Simulator Group, Applied Research and Standards Division/Communications Research Laboratory/Koganei, Tokyo)

Even so, March is one of the optimal DX months. As the Spring Equinox approaches, the gray line begins to run straight north and south. With the return of sunlight to the polar north, the HF bands are improving.

Ten meters will be spotty, with the most reliable propagation along north/ south paths. Occasional strong but short openings may occur between stations on east/west paths into Asia and Europe. These paths will quickly disappear as we move into April, so don't miss out.

Fifteen meters will be much more usable than 10. We will find 15 staying open longer into the evenings, being the band of choice as we move through the month of March and into April. Daytime paths will not degrade much until midsummer. You will see more early closures if you live closer to the North Pole.

Seventeen and 20 meters will remain in good shape. Both short- and long-path circuits are reliable and solid. All nighttime paths are wide open during March. Primetime evening hours in the United States are sunrise hours across Russia, Africa, and both the Near and Far East. Expect a lot of short- and long-path DX into these areas of the world.

Between sunset and midnight, expect DX openings on all bands between 20 and 160 meters, with occasional openings on 15 and 17 when conditions are High or Above Normal. Conditions on 30, 40, 60, 80, and 160 meters should favor openings to the east and south. These bands should peak for openings to Europe and Africa near midnight.

From midnight to sunrise, expect optimum DX conditions on 30, 40, 60, 80, and occasionally 160 meters. Conditions should favor openings toward the west and south. Some rather good 20-meter openings should also be possible toward the south and west during this time.

Daytime MUFs continue to drop and the *Ap* is on the rise, so take advantage of the current excellent conditions and work the world!

VHF Propagation

The possibilities for ionospheric openings on the VHF bands usually improve during March and the spring months. Many of the solar-ionospheric relationships that can produce ionospheric openings on the VHF bands tend to maximize during equinoctial periods.

A very slight increase in short-skip openings due to sporadic-*E* propagation generally takes place during March, and an occasional 6-meter opening may be possible during this month. Sporadic-*E* openings most often occur during the daylight hours over distances between about 1000 and 1400 miles. There is also a good chance for an increase in widespread auroral activity during March, accompanied by auroral-scatter-type openings on 6 and 2 meters. Check the Last-Minute Forecast at the beginning of this column for those days in March that are expected to be Below Normal or Disturbed. These are days on which auroral activity is most likely to occur.

Conditions should be optimal during March for trans-equatorial scatter propagation between the southern tier states and countries deep in South America. The best time for TE openings should be between 8 and 11 PM local time. Don't forget to check out my column in *CQ VHF* magazine for more details on VHF propagation and conditions.

Current Solar Cycle Progress

The Royal Observatory of Belgium reports that the monthly mean observed sunspot number for December 2004 is 18, a huge drop from November's 43.7. The lowest daily sunspot value during December was recorded on December 15 was 8. The highest daily sunspot count was 32 on December 1. These high and low marks are significantly lower than the spread in November. The 12-month running smoothed sunspot number centered on June 2004 is 44, down three-tenths from May's 44.3. A smoothed sunspot count of 31 to 34 is expected for March 2005 by the SIDC. The SEC predicts the sunspot count to be 22, give or take about 12 points.

The Dominion Radio Astrophysical Observatory at Penticton, BC, Canada, reports a 10.7-cm observed monthly mean solar flux of 94.6 for December 2004, a bit lower than November's 113.2. The 12-month smoothed 10.7-cm flux centered on June 2004 is 107.2, just down from May's 109.2. The predicted smoothed 10.7-cm solar flux for March 2005 is about 85, give or take about 16 points.

The observed monthly mean planetary *A*-index (*Ap*) for December 2004 is 11, a nice drop from November's 26. The 12-month smoothed *Ap*-index centered on June 2004 is 14, about the same as for May. Expect the overall geomagnetic activity to be quiet to active during most days in March, with some isolated periods of storm level activity, since we are in the Equinoctial season. Refer to the Last-Minute Forecast for the outlook on the days this might occur.

Please come and participate in my online propagation discussion forum at <http://hfradio.org/forums/>. I've also enhanced my Space Weather and Radio Propagation center at <http://prop.hfradio.org>, so take a look. These resources may also be viewed on a cellphone or other wireless device that has WAP/WML features by browsing to <http://wap.hfradio.org>.

Drop me an e-mail or send me a letter if you have questions or topics you would like to see me explore in this column. I'd also love to hear any feedback you might have on what I have written. Until next month . . .

73, Tomas, NW7US/AAA0WA

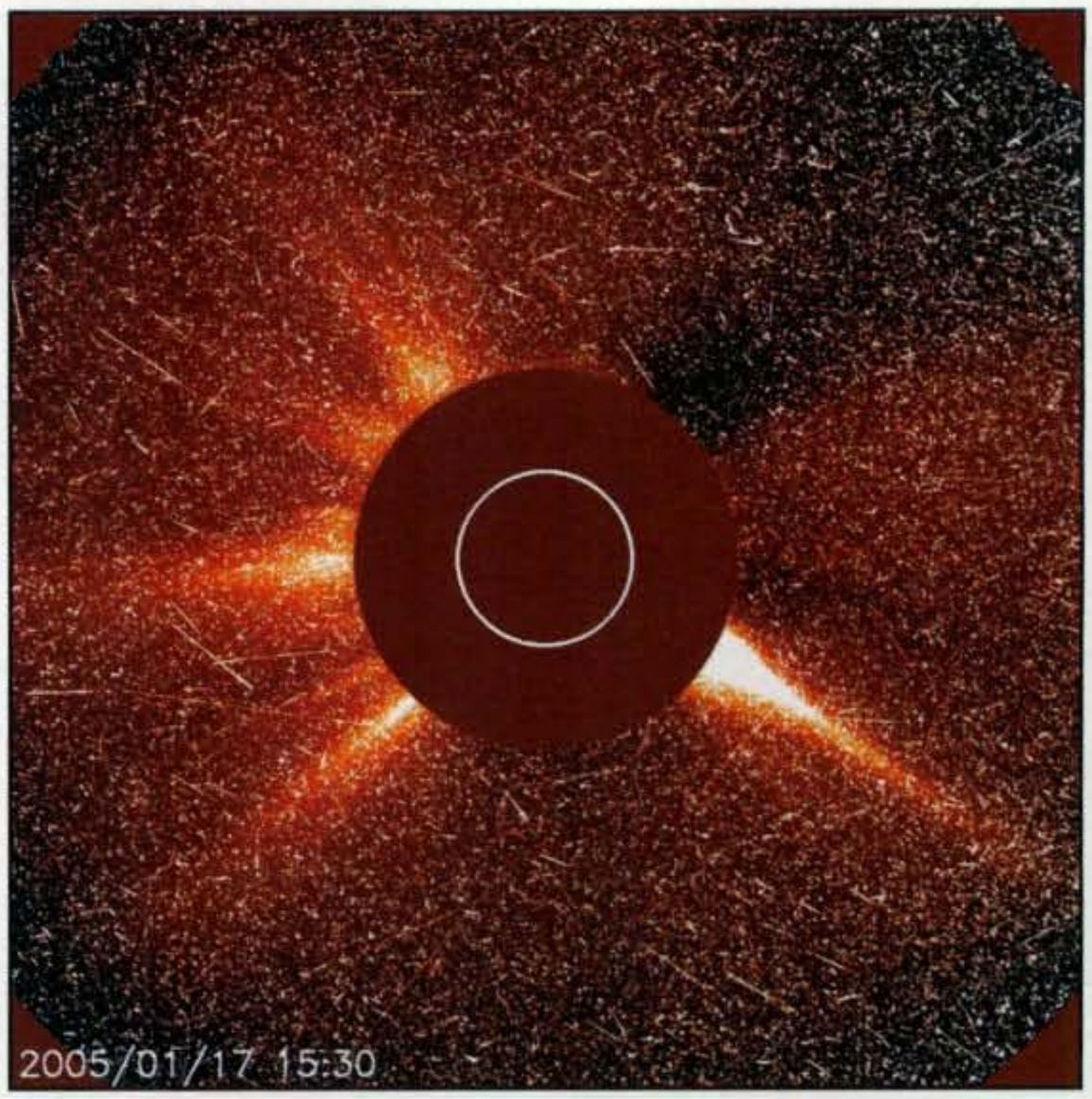

Fig. 15– The influence of proton saturation on the imaging equipment of one of several satellites that observe our sun. The "noise" is due to bombardment of protons during the extreme proton storm caused by active solar region 10720. (Source: NOAA/SEC)

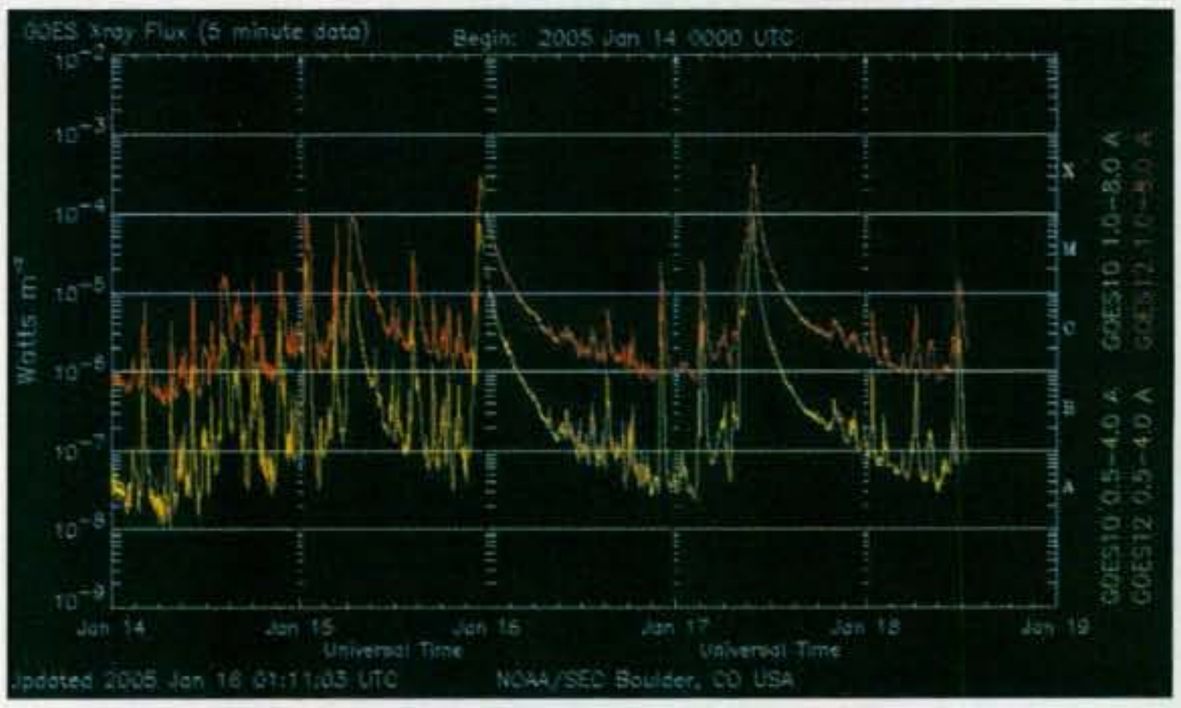

Fig. 16– The record of flares from sunspot group 10720 and 10718, from January 14 to the middle of January 18. Nearly all of these flares are from active region 10720. Note the long decays from the two X-class flares, as well as the long decay from the M8-class flare on January 15. At the end of the record, note another M-class flare has errupted. (Source: NOAA/SEC)

VHF Propagation

A guide For Radio Amateurs

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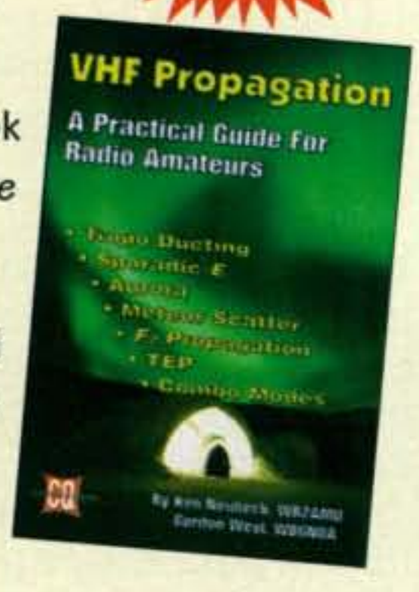

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Results of the 2004 CQ WW WPX CW Contest *(from page 27)*

through the speaker all weekend, but got most of the new ones, though hard here! I went to see if 10 was open and heard AYØF; not even tuned up and worked him—only QSO there!... **KS7T.** The case of the missing dits: The meek, mild-mannered ham slumped in Perry Mason's comfortable client chair.... **KS9K.** I'm starting to enjoy the required off times and strategy involved in choosing them even though I always take off the wrong times! ... **KT1V.** Conditions were as good as can be expected. Twenty meters was the workhorse band. JA's were sorely missed.... **KW9N.**

One-half to 2 watts from my Elecraft KX1 and a 28 foot piece of wire tossed into a tree or hung out the hotel window. Golden Ears Award to OH6BG, who heard me, my only DX contact while attending my son's graduation from Cornell.... **N6XI/2.** Condx were good on 40 meters. Great job by Tom, K1KI, also operating 40 meters again this year.... **NK4A.** I almost wore out my key.... **NN5AA.** Fun, fun, fun. No 28 MHz, little 21 MHz sign of the times!.... **NR7DX (K7ABV).** WPX is still one of the best contests! It is always fun to work some odd call only to find it is someone you know! Thanks to all who were on and called in. Thanks to Dick, KB1H, for the fine station.... **NZ1U.** QRN not bad. Skip went long both nights so not a lot of stateside Qs but had fun anyway! ... **W1FJ.** Didn't have much time but still fun making a few contacts even with only 35 watts and an indoor dipole! ... **W1OH.** Only had a few hours on, with company at the summer QTH. Long enough to remind me how much I love CW! ... **W1WEF.** Condx awful both nights with band noise at S9 +10.... **W2CDO.** It was fun time with 50 watts + 5 foot whip on the trunk lid! ... **W3GRX.** A token effort in an attempt to improve my poor CW skills. Thanks for the patience. Wow—you folks are fast! ... **W4KAZ.** Great contest. Good band conditions. Nice weather to be indoors.... **W7DPW.** Great contest for QRPers. This is my best effort in the QRP category.... **W8VE.** Keeping the spirit of K4OJ alive.... **WE4OJ.**

DX QRM

Participated in the CQ WPX for the first time. Enjoyed contacting high-speed high-power stations with a dipole antenna and low power. Wish to come up with an improved setup next year.... **4S7NI.** This is the special station for the Kansai amateur radio revitalizaion month.... **8N3KAN/3.** Thank you to Sangat, 9M2SS, for letting me operate from 9M2RPN, Kuala Lumpur Planaterium station. Limited propagation to North America but still an enjoyable contest.... **9M2/G4ZFE.** Monsoon thunderstorms; large lightning bolts most of the weekend and low power in the middle of nowhere. What a blast! ... **9V1GO.** Terrific weekend near the German-Dutch border! Completing the station setup just 10 minutes prior to start of the battle, we were amazed how smoothly everything finally worked out. Good short-skip to Europe on 15 and 10 for the first 36 hours helped keep us sharp... **DL8WPX.** Part-time effort for the fun and training, but full pleasure. Just enough Qs to achieve a weekend DXCC.... **F6IRF.** First time I've made 2000 Qs/2M points in this contest. However, I really need to do more low-band operating and from somewhere

TROPHY WINNERS AND DONORS

SINGLE OPERATOR, ALL BAND

WORLD: Steve Bolia, N8BJQ Trophy. Won by: **D4B operated by Alexander Teimurazov, 4L5A.**
USA: Dennis Motschenbacher, K7BV Trophy. Won by: **Bob Shohet, KQ2M.**
EUROPE: Ivo Pezer, 5B4ADA/9A3A Trophy. Won by: **GI1A operated by Sergei Rebrov, MØSDX.**
OCEANIA: Tom Morton, K6CT Trophy. Won by: **9M6A operated by Toivo Hallikivi, ES2RR.**
CANADA: Radio Amateurs of Canada (RAC) Trophy. Won by: **VY2TT operated by Ken Widelitz, K6LA.**
JAPAN: The DX Family Foundation Trophy. Won by: **Masa Okano, JH4UYB**.
WORLD LOW POWER: Caribbean Contesting Consortium Trophy. Won by: **8P5A operated by Tom Georgens, W2SC.**
USA LOW POWER: Terry Zivney, N4TZ Trophy. Won by: **John Bayne, KK9A.**
ZONE 3 HIGH POWER: Jim Pratt,N6IG Trophy. Won by: **Carl Cook, AI6V @ K6IDX.**
USA ZONE 4 HIGH POWER: Society of Midwest Contesters Trophy. Won by: **KW9N operated by Pat Barkey, N9RV.**
USA ZONE 4 LOW POWER: Society of Midwest Contesters Trophy. Won by: **KS9K operated by Terry Zivney, N4TZ.**

SINGLE OPERATOR, SINGLE BAND

WORLD 7 MHz: William D. Johnson, KVØQ Trophy. Won by: **IG9B operated by Simone Candotto, IV3NVN.**
WORLD 3.5 MHz: Lance Johnson Digital Graphics Trophy. Won by: **Robert Bajuk, S57AW.**
USA: Kansas City DX Club Trophy. Won by: **KC1XX operated by Willard Myers, K1GQ (14 MHz).**
USA 28 MHz: Bernie Welch, W8IMZ Memorial Trophy. Won by: **NN5AA operated by Richard King, K5NA.**
USA 21 MHz: Wayne Carroll, W4MPY Trophy. Won by: **Fritz Reuning, K4OAQ.**
USA 14 MHz: W6EE Memorial (NN6EE sponsor). Won by: **John Golomb, N2NC @ N2RM.**

MULTI-OPERATOR, SINGLE TRANSMITTER

WORLD: Ron Blake, N4KE Trophy. Won by: **Station P40O operated by LY2CY and LY2TA.**
ASIA: W2MIG Memorial (NT4TT sponsor). Won by: **Station RT9W operated by RU9WX, RX9WR, RW9WW, RW9WY, RA9WUA, UA9-084-494, & RA9WR.**
USA ZONE 4: Society of Midwest Contesters Trophy. Won by: **Station NO5W operated by NO5W, N1LN , K5GN, N5RP, NT5TU, K5GA, & K5NZ.**

MULTI-OPERATOR, MULTI-TRANSMITTER

World: Steve Merchant, K6AW Trophy. Won by: **Station A61AJ operated by A61AJ, G3SXW, JE1CKA, K1ZZ, K3EST, ON5NT, PY5EG, S50A, S53R, SMØCXU, W6OAT, & W6OSP.**

CONTEST EXPEDITION

WORLD: Steve Bolia, N8BJQ Trophy. Won by: **Station 5I3A operated by Mike Stange, DL4SM.**

COMBINED SSB/CW
SINGLE OPERATOR, ALL BAND

WORLD: Al Slater, G3FXB Memorial. Won by: **D4B operated by Alexander Teimurazov, 4L5A.**

Club (SSB & CW)

WORLD: *CQ* Magazine Trophy. Won by: **The Bavarian Contest Club.**

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(how?!). Find and work more DX QSOs and mults! Conditions weren't great, although low bands were fair and 10m enjoyed a good Es. . . . **GØMTN.**

Great weekend and pleased with my results on QRP. The K2 is really a great CW contest rig. Conditions mixed; plenty of bulk on HF and nice sporadic-*E* on 10m, but not much sign of wall-to-wall USA stations. The sunspots are well down! . . . **G3YMC.** Excellent fun in the contest and goes to show what you can achieve with 100W/vertical and CW from a postage stamp of a garden. Very pleased to break 1000 Qs from home. . . . **G5W (GØWAT).** Special event station to mark Hungary's accession to the European union. . . . **HA2004EU.** Ten-Tec Argonaut V 5 watts. Dipole multiband up in the mountains and all on battery. . . . **I1BAY.** Hello, dear contesters. I am very glad because there are many stations on the air. Good propagation also in 10 meter band. I hope to meet you again next test. . . . **IT9ORA.** The condition of my stomach was very poor at the time of start of the contest. However, at the end of the contest it became good. Why? . . . **JH2NWP.** Have shared the 48 hours with SJ9WL, the Swedish callsign of Arim's club station. The 1005 QSOs is my best result in 24 contest-hours. . . . **LG5LG.** Conditions moderate. Few US/Canadians heard here but managed best score so far. Hard going for this retired QRPer! Thanks, guys. . . . **MØO.**

OHØEC was operated in a temporary setup during a small-scale DXpedition to Aland Isl., using a Spider beam and a Windom antenna. The start of the contest was a bit difficult; my 100 watts overheard mostly. But after some hours the real fun started. Thanks to all. . . . **OHØEC.** Had two things: fun and aurora! . . . **OH1F.** Field Day style operation with fishing-pole vertical antennas. Station A was using 500 watts and Station B was 100 watts. We were lucky to have only moderate winds so the tent didn't blow away. Nights where pretty cold but the stove worked nicely behind our backs when sitting. . . . **OJØSM.** Very nice mini-expedition to countryside. For me it was also preparation for HF World Championships in July. Thanks to all for QSOs! . . . **OL8M.** Just a quick trip to air the fairly rare ONØ prefix. . . . **ONØ/G3VQO/p.** I utilize only the S& P method for the pleasure of the CW and to find all contest friends. Many thanks to all for the answers to my call. Five watts on 40m with a delta loop. This is hard, hi. . . . **ON6TJ.** This was my second time in this contest from outside the USA, so I'm running out of excuses. Suffice it to say, I appear to still be on a steep learning curve when it comes to pulling stations out of the at times overwhelming pile-ups. Had lots of fun. . . . **P40L.**

Again a great time. Lots of activity on all bands worked with my dipole and just 50 watts out the world. Try to do this on normal weekend and you don't have this contact rate! Glad to have WPX weekends! . . . **PA1V.** This time I did what the experts say about how to prepare yourself for a contest. I arrived at Boa Vista Tuesday night and with Sergio and Walter. We set up the station. Wednesday through Friday I tested the station. Made a lot of QSOs and slept a lot. . . . **PT5A.** 14 MHz crowded during all the day. Shows us CW is still alive and well. . . . **PY7GK.** Propagation is bad! DX, where have you been? . . . **RA6LW.** I was often rcvd as S50VBA! . . . **S5046A.** Lots of fun as usual. SC2 prefix aired for the first time! . . . **SC2AG.** I shared the 48 hours with LG5LG, the Norwegian callsign of Arim's club station. Never before I've done 717 QSOs within 24 hours in a contest. . . . **SJ9WL.** Propagation from Rhodes (EU-001) was very modest this year. I took part in this contest without any previous preparations at all! Right after work Friday evening I got to the club of SV5RDS, where everything was already set up. I brought just my laptop. . . . **SV5DKL.** QRP contesting is very challenging at this stage of the sunspot cycle! I want to thank Phil, NØKE, my long-time friend, contester, and QRP advocate, for his many helpful suggestions, especially in developing a strategy for taking off time. . . . **TI5N.**

First time entered Assisted category, though operated just for fun/training. See you next year for more serious effort. Contest is super and thank you for celebrate. . . . **UR7EQ.** This is our debut. . . . **UT1U.** VA7OO operating from VE7GL. Food by VE7IJH and VE7HJJ; tower work by VA7VZZ. No major issues other than rotten conditions on the second day. Some good worldwide openings on 40m, including some

WORLD TOP SCORES

SINGLE OPERATOR ALL BAND

D4B (4L5A)	16,619,000
3V8BB (YT1AD)	13,765,728
CS3B (CT1BOH)	11,912,985
OC4WW (OHØXX)	10,996,334
P4ØL (W6LD)	10,338,074
ZF1A (K6AM)	9,358,520
*8P5A (W2SC)	9,034,060
VY2TT (K6LA)	8,497,280
GI1A (MØSDX)	7,476,080
PJ2W (WI9WI)	7,350,001
FY5FY	7,158,552
KQ2M	7,157,205
ZS4TX	6,964,140
YT6A	6,892,628
KW9N (N9RV)	6,698,560
IR4T	6,409,400
KC3R (LZ4AX)	6,047,565
VE3EJ	6,041,074
CT3KN	5,864,082
KN1DX (K4ZW)	5,863,530

28 MHz

AYØF (LU2FM)	1,920,402
PS2E (PY2EX)	492,038
4X1VF	487,326
UUØA (UUØJX)	389,064
*9A3VM	184,402
NN5AA (K5NA)	145,625
9V1YC	112,480
YO3FF/P	102,600
*HA1ZZ	90,936
SP9W	76,973

21 MHz

PT5A (PY2EMC)	6,139,755
PX2A (PY2WB)	4,991,625
LU5FC	3,144,980
*5I3A (DL4SM)	3,005,952
*9M8DX (VK6DXI)	2,684,112
5B4AHA	1,986,282
YZ1AU	1,592,784
OHØV (OH6LI)	1,450,608
LT1F (LU1AEE)	1,347,672
YT1BB	1,243,125

14 MHz

4L8A	5,322,216
9A5W	4,443,300
N2NC (@N2RM)	4,301,808
9A8A	3,873,424
KC1XX (K1GQ)	3,861,778
4N9Z	3,498,096
OM2VL	3,480,570
VC6X (VE6BF)	3,208,044
OH4A (OH6QU)	3,196,791
IU9S (IT9BLB)	3,126,487

7 MHz

IG9B (IV3NVN)	5,187,819
SN7Q	4,013,658
KG1D (K1KI)	3,681,828
VO1AU	3,395,280
IU3X (IV3SKB)	3,060,540
KH6ND	2,995,778
NK4A (N4PN)	2,813,692
US1ITU	2,762,448
YV5OHW	2,746,107
S510I	2,540,412

3.5 MHz

S57AW	1,333,014
YR2I (YO2DFA)	997,488
ZC4/G3AB	807,088
YL2PQ	744,876
YL9W	741,596
OK1RR	710,328
SQ4MP	696,150
F5NBX	684,613
EU1AZ	674,304
SP4DEU	657,944

1.8 MHz

HA8BE	293,388
LY2BW	262,615
S57M	254,597
*LY5A	189,154
*USØZZ	167,307
T99Z	142,596
*OL6T (OK1DCF)	139,360
*UX5NQ	138,204
*UT1FA	121,600
*YU1RA	101,903

LOW POWER ALL BAND

8P5A (W2SC)	9,034,060
9H3MM (DF4SA)	4,647,705
NH2DX (KG6DX)	2,977,380
UN7MO	2,955,810
UA4FER	2,781,432
YO3APJ	2,346,792
RW3GB	2,252,775
EM3H (UR3HC)	2,248,932
KK9A	2,199,535
DL2OBF	2,153,088
WK2G	2,110,374
HSØAC (E21EIC)	2,090,529
PR7AB	2,034,922
OH4R (OH4YR)	1,999,404
LZØ4KM (LZ3YY)	1,971,162

28 MHz

9A3VM	184,402
HA1ZZ	90,936
NA4W (K4WI)	53,284
IR8C (IZ8EQF)	49,063
YU1FG	41,976
CT1AOZ	35,644
SP3LWP	35,321
OK2HZ	30,915
KN4Y	28,910
OK2BGK	26,624

21 MHz

5I3A (DL4SM)	3,005,952
9M8DX (VK6DXI)	2,684,112
4Z5FW	1,065,000
9A6C	973,056
URØMC	597,054
LU3FL	572,276
YD3LGF	441,945
S57J	420,945
RN1TN	357,019
PY8DAN	349,272

14 MHz

Z37M (Z32ID)	2,223,760
LU5FF	1,845,657
LY9A (LY3BA)	1,623,410
RU3HD	1,422,420
T94FC	1,220,802
HG6V (HA6IAM)	1,220,704
J43J (DJ5JH)	1,211,860
A45WD (YO9HP)	1,191,036
HB9/OM3CGN	1,172,808
UR4ZWL/P	1,130,320

7 MHz

4XØX (4Z5AX)	2,160,060
TA3DD	2,147,200
T9/9A5AX (T99W)	1,861,398
HG8I	1,552,320
S53F	1,490,778
AN7WA	1,416,882
YR5A (YO5OHO)	1,295,800
S54A	1,278,654
SP5KEH (SP5JTF)	1,067,724
ZT6T (ZS6MG)	1,051,650

3.5 MHz

4N6ØØA (YU1YV)	600,008
S5Ø47L (S57L)	511,825
SP9XCN	478,485
LY3CW	418,931
4Z5LA	360,880
LA7AK	334,058
AM3AKY	277,344
HA4FV	262,542
LA3BO	211,000
SQ9UM	187,308

1.8 MHz

LY5A	189,154
USØZZ	167,307
OL6T (OK1DCF)	139,360
UX5NQ	138,204
UT1FA	121,600
YU1RA	101,903
EV6M	95,842
UT3NK	81,158
9A3RE	69,237
LY4BF	48,128

TRIBANDER/SINGLE ELEMENT

CT3KN	5,864,082
TI3M (TI3TLS)	4,791,456
RA9SG	4,706,565
*9H3MM (DF4SA)	4,647,705
HG8R	4,101,084
AN5FV	3,913,785
ISØ/S52A (S59AA)	3,854,228
G3XTT	3,462,030
9M2/G4ZFE	3,403,260
RZ3AZ	3,389,664
*NH2DX (KG6DX)	2,977,380
OL5Y	2,830,750
OE5CWL/6	2,733,970
HA3LI	2,625,456
N2GC	2,538,102

ROOKIE

*US6IMA	779,394
*YL3GCU	231,378
W6SJ	154,985
*EI7JK	135,595
KR4M	130,562
*JA1HTG	82,104
*KY2T	50,337
*VA3HUN	49,742
*N7EIE	32,643
*AE6NY	23,520

QRP/p

YT7TY	A	1,769,600
TI5N (W8QZA)	A	1,737,868
OT4A (JK3GAD)	A	1,161,126
OL4W (OK1IF)	A	875,805
SM3C (SM5CCT)	A	809,952
G3YMC	A	600,544
DF3AX	A	592,644
UA4ARL	A	567,424
LA5EKA	A	453,222
LY2ØØ4E	A	446,886
JR3RWB	28	2,448
SP9H	21	152,048
EW6CU	21	111,230
JR1NKN	21	44,820
HAØGK	21	34,300
HSØZCW	21	34,210
YT1CS	14	503,010
EU8RZ	14	420,210
HB9DAX	14	335,232
RW3AI	14	211,888
SP9NSV	14	163,305
OK1IR	7	442,848
LY5G (LY2FE)	7	402,880
T93W	7	293,150
SP4GFG	7	280,224
OH3BU	7	259,272
RA3XAR	3.5	45,000
UA3LIZ	3.5	28,408
ON4AEB	1.8	23,552
RZ3VA	1.8	13,832
LY1BA	1.8	11,270
SO6A	1.8	5,450

SINGLE-OP ASSISTED

RG9A (UA9AM)	7,353,010
JY9QJ	7,295,508
K3WW	5,997,446
KI1G	5,076,994
S57DX	5,037,864
LY4XX	4,266,448
RD3A (RD3AF)	4,161,520
UW8M (UR5MID)	3,760,304
YT9X (YU1ZZ)	3,319,344
RZ9HG	3,196,024
YL6W (YL2GD)	3,169,824
W1US (K1LZ)	3,124,319
RN3QO	3,058,809
HB9DDO	3,025,902
SN8F (SP8FHK)	2,956,347

MULTI-OPERATOR SINGLE TRANSMITTER

P4ØO	19,456,480
PS2T	14,473,564
VQ5V	12,951,027
RT9W	10,997,918
ED6IB	10,640,619
UA9AYA	10,449,544
OM7M	8,985,150
RW9C	8,698,560
T93M	8,014,938
RL3A	8,011,990
HG1S	7,772,000
HG6N	7,325,826
RZ9OZO	7,236,131
NO2R	6,969,490
OL8M	6,941,488

MULTI-OPERATOR TWO TRANSMITTER

PJ4U	17,502,264
KM4M	16,283,745
RU1A	12,502,208
UU7J	10,553,056
WE4OJ	8,248,032
VE7SV	7,663,365
ZX3S	7,506,176
DAØBCC	7,061,873
LY4A	6,923,875
WR3Z	5,790,164
SO6Y	5,486,684
OJØSM	4,873,968
OL7D	4,340,292
NM7D	3,839,040
WX5S	3,788,934

MULTI-OPERATOR MULTI-TRANSMITTER

A61AJ	35,088,914
DL8WPX	18,949,707
LZ9W	16,735,552
ZL6QH	16,143,840
NY4A	14,703,940
LY7A	10,291,494
JE1ZWT	8,343,780
NN5J	7,535,628
NG3U	1,742,460
JA1ZLO	1,357,920

**Low Power*

long-path to Europe. . . . **VA7OO.** CQ contests are tons of fun. I wish I could have operated longer but lots of QRM from the non-hams plus great WX on the weekend combined to shorten my on-air activities. Maybe I'll go remote next year! . . . **VE3JAQ.** Great conditions provided a great opportunity to prove out my new 40m antennas. I broke the eight-year-old Canadian 40m HP record this time. . . . **VO1AU.** Thank you Dave, Bud, and Pat for making it possible for us to operate from the fabulous VP5B contest station again. . . . **VQ5V.** On a stealth mission to Whistler, BC with my trusty HW16 and a roll of wrap wire poking out the window to a tree across a very busy street, just over the height of the cars and trucks. A good time was had by all. . . . **W7DRA/VC7.**

Was in Chile looking for transportation to Peter I next January. Managed to operate from the beach home of NP4IW/6. Tks, Carlos. . . . **XR2F.** Many thanks to my host, Vali, YO2LDC, and his XYL, Olghita, YO2LOC, for the opportunity to operate his radio club contest station, YO2KIV, during WPX CW with the callsign YR2I! . . . **YR2I.** Disappointing conditions on 80, 15, and 10m, but still a new Oceania record, we hope. Forty and 20 were our best bands. . . . **ZL6QH.** ZM6CL is a short-term special event call we have to celebrate the 150th anniversary of Masterton, the main town of the Wairarapa region. It was great to be able to give out a unique prefix, although some took some convincing they had the call correct! . . . **ZM6CL.**

CQ WW WPX CW CONTEST ALL-TIME RECORDS

The contest is held each year on the last full weekend of May. The All-Time Records are updated and published annually. Data shown below is: callsign, year of operation, total score, and number of prefix multipliers.

WORLD RECORD HOLDERS
Single Operator

1.8	IH9/OL5Y('98)	341,068	182
3.5	TAØ/Z33F ('02)	1,452,522	348
7.0	LU1IV('97)	7,671,456	702
14	EA9LZ('98)	5,708,498	758
21	A45XR('99)	6,557,697	843
28	ZX5J('02)	6,787,440	857
AB	D4B('04)	16,619,000	1000

Multi-Operator Single Transmitter

P49V('01)		19,760,774	1034

Multi-Operator Two Transmitters

HC8N('03)		54,697,072	1189

Multi-Operator Multi-Transmitter

HC8N('99)		54,697,072	1264

U.S.A. RECORD HOLDERS
Single Operator

1.8	K1ZM('95)	40,446	107
3.5	K1ZM('93)	406,080	288
7.0	KG1D('03)	2,999,854	617
14	N2NC('04)	4,301,808	826
21	NU5A('99)	4,411,299	789
28	WW4M('01)	2,547,046	674
AB	AJ1I('01)	8,213,226	849

Multi-Operator Single Transmitter

KM9P('01)		10,691,724	964

Multi-Operator Two Transmitters

KM4M('04)		16,283,745	1095

Multi-Operator Multi-Transmitter

KM3T('01)		21,103,320	1110

CLUB RECORD
Northern Calif. Contest Club('02).....253,543,497

WPX (Prefix) RECORD
HC8N('01).....1299

QRP/p RECORD
P4ØW('97).....4,018,208

CONTINENTAL RECORD HOLDERS

AFRICA

1.8	IH9/OL5Y('98)	341,068	182
3.5	EA8/OH2KI('96)	1,358,852	347
7.0	IG9B('04)	5,187,819	613
14	EA9LZ('98)	5,708,498	758
21	5X1Z('01)	6,362,352	782
28	ZS4TX('01)	4,602,028	722
AB	D4B('04)	16,619,000	1000

ASIA

1.8	4X4NJ('96)	259,420	170
3.5	TAØ/Z33F('02)	1,452,552	348
7.0	TA3/G3AB('03)	4,266,512	571
14	4L8A('04)	5,322,216	824
21	A45XR('99)	6,557,697	843
28	HZ1AB('02)	3,669,994	659
AB	P3A('01)	10,723,620	870

EUROPE

1.8	HA8BE('04)	293,388	276
3.5	S57AW('04)	1,333,014	489
7.0	SN7Q('04)	4,013,658	699
14	9A5W('95)	4,443,300	900
21	9HØA('02)	5,389,008	933
28	9HØA('01)	3,965,315	841
AB	GI1A('04)	7,476,080	904

NORTH AMERICA

1.8	VA1A('99)	103,680	120
3.5	FM5BH('97)	833,490	315
7.0	V26BA('97)	6,227,550	659
14	FM5BH('98)	4,642,866	762
21	ZF1A('99)	5,330,129	799
28	FM5GU('01)	2,849,769	621
AB	WP2Z('99)	12,506,280	890

OCEANIA

1.8	KX6DC('88)	12,240	45
3.5	KX6DC('89)	258,258	143
7.0	ZM1A('98)	5,144,480	592
14	KH6ND('03)	4,126,690	730
21	KH6ND('99)	6,107,256	813
28	KH6ND('00)	1,523,008	424
AB	KH6ND('02)	7,996,774	862

SOUTH AMERICA

1.8	YV1OB('86)	11,550	35
3.5	YX3A('89)	1,004,060	305
7.0	LU1IV('97)	7,671,456	702
14	YW1A('91)	4,617,456	732
21	PT5A('04)	6,139,755	855
28	ZX5J('02)	6,787,440	857
AB	P4ØW('94)	14,168,115	845

MULTI-OPERATOR SINGLE TRANSMITTER

AF	3V8BB('02)	19,041,135	1065
AS	P3A('02)	18,176,342	1046
EU	9A7A('01)	10,915,020	1044
NA	8P4A('02)	18,516,960	1056
OC	AH2R('01)	11,541,420	957
SA	P49V('01)	19,760,744	1034

MULTI-OPERATOR TWO TRANSMITTERS

AF	No Entry		
AS	RT9W ('03)	12,006,568	872
EU	R300SP ('03)	12,793,452	1054
NA	KM4M ('04)	16,283,745	1095
OC	ZL6QH ('03)	12,029,472	884
SA	HC8N ('03)	30,928,268	1187

MULTI-OPERATOR MULTI-TRANSMITTER

AF	6V6U('97)	9,938,896	758
AS	A61AJ('02)	42,766,232	1244
EU	4OØA('00)	20,932,902	1143
NA	6Y2A('02)	38,821,328	1274
OC	ZL6QH('04)	16,143,840	1010
SA	HC8N('99)	54,697,072	1264

QRPp

AF	5Y4FO('92)	649,057	311
AS	ZC4BS('02)	2,515,388	521
EU	LY5A('01)	2,331,414	646
NA	TI5X('01)	2,568,470	615
OC	FO8JP('86)	572,131	259
SA	P4ØW('97)	4,018,208	632

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- **Temperature.** Current and each of last 24 hours. Wind chill, heat index.
- **Humidity & Dew Point.** Current and each of last 24 hours.
- **Rain.** Last 15 minutes. Last 24 hours, days, months, years. Last 24 storms.
- **Rain Rate.** Current and each of last 24 minutes.
- **Wind Speed.** Current, 10-min. avg., avg. for each of last 24 hours.
- **Wind Direction.** Current and last 24 hours, days, and months.
- **Optional.** UV and solar radiation, ET, soil moisture, leaf wetness.
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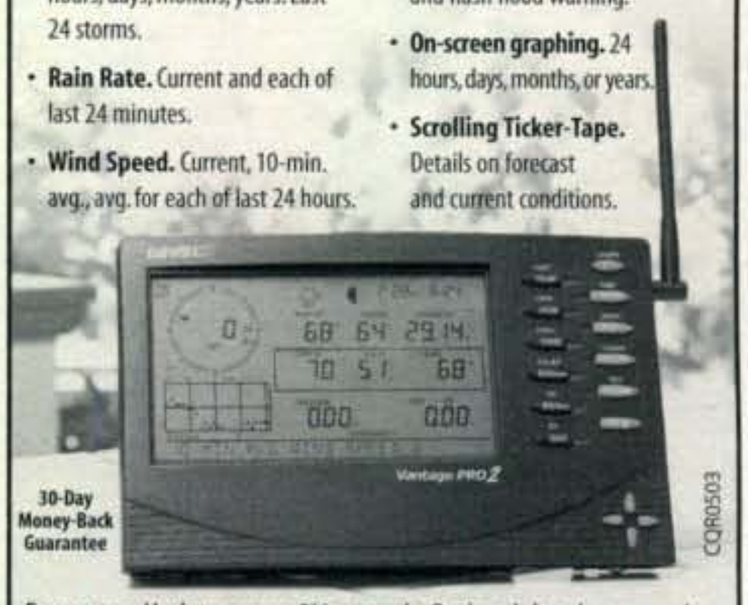

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KQ2M	7,157,205
KW9N (N9RV)	6,698,560
KC3R (LZ4AX)	6,047,565
KN1DX (K4ZW)	5,863,530
KT1V	5,524,896
KK4TT (W4PA)	5,270,539
K3ZO	5,033,904
AA3B	4,793,330
AI6V (@K6IDX)	4,056,096
NT5C (N3BB)	3,878,901
KY4AA (N4GN)	3,734,640
KT3Y	3,686,265
WD4K (KØEJ)	3,681,222
WXØB (AD5Q)	3,512,712
N2YO	3,429,343
NE6N (N6RT)	3,270,807
NU1P (K1MK)	2,836,751
NØKE	2,830,347
WA6O (@N6RO)	2,694,123
KN7NV (K7NV)	2,628,120

28 MHz

NN5AA (K5NA)	145,625
NU4BP (N4BP)	54,516
*NA4W (K4WI)	53,284
*KN4Y	28,910
*NX5M	14,790

21 MHz

K4OAQ	704,700
K2BA	649,350
K1UM	308,648
*N5AW	224,361
*WA1FCN	178,358

14 MHz

N2NC (@N2RM)	4,301,808
KC1XX (K1GQ)	3,861,778
N9TK	2,155,041
W9WI	1,472,618
W5FO	1,357,590
K7ZZ	1,279,641
*K9QVB	1,076,920
*K8IA	1,006,560
K9OM	717,570
KW5DX (K1NT)	604,467

7 MHz

KG1D (K1KI)	3,681,828
NK4A (N4PN)	2,813,692
W3BGN	2,186,042
NI1N	1,765,125
AC6DD	1,191,528
*NT1E (K3BU)	897,230
*N4NX	438,400
K9CC	377,872
*K4SV	327,418
*K9WJU (W9CG)	95,524
*AA7FK	56,168

3.5 MHz

W1FJ	271,860
K6OY	160,398
WA5VGI/6	159,272
NT6K	101,592
*WB2DVU	79,980

LOW POWER ALL BAND

KK9A	2,199,535
WK2G	2,110,374
KS9K (N4TZ)	1,857,114
NV1N (N1UR)	1,856,718
N2MM	1,717,326
AA6PW	1,394,660
WA1S	1,381,990
KT8X (W8MJ)	1,356,800
WB2AA	1,352,574
N5DO	1,285,353
N6HC	1,247,344
NE9U	1,009,944
N7WA	989,135
N4IG	975,416
WR1TE (W1JQ)	652,589

28 MHz

NA4W (K4WI)	53,284
KN4Y	28,910
NX5M	14,790

21 MHz

N5AW	224,361
WA1FCN	178,358
N2GM	120,840
WB4TDH	51,744
K9WA	31,742

14 MHz

K9QVB	1,076,920
K8IA	1,006,560
KV8Q	382,130
K9BG	259,251
W9ILY	252,540
KS4Q	237,690
N8II	189,816
KI4FDF	177,844
K1BV	128,709
NJ3K	127,456

7 MHz

NT1E (K3BU)	897,230
N4NX	438,400
K4SV	327,418
K9WJU (W9CG)	95,524
AA7FK	56,168

3.5 MHz

WB2DVU	79,980
W2CDO	11,484
K5RX	10,336

TRIBANDER/SINGLE ELEMENT

N2GC	2,538,102
AK2P (W3MMM)	2,430,000
K4BAI	2,188,095
N6CW	2,001,144
N3UM	1,917,272
*WA1S	1,381,990
*WB2AA	1,352,574
AD4EB	1,261,050
*N6HC	1,247,344
N8PW	1,040,638
W4BQF	1,018,354
WA9IRV	1,005,168
W6TK	938,442
*WR1TE (W1JQ)	652,589
*WN6K	647,112

ROOKIE

W6SJ	154,985
KR4M	130,562
*KY2T	50,337
*N7EIE	32,643
*AE6NY	23,520

QRP/p

N7IR	A	439,005
KE4R	A	430,605
W8VE	A	334,458
KA1LMR	A	186,440
WA8REI	A	113,078
W1CVE	21	12,960
WA6FGV	21	6,720
W6YJ	14	72,726
K4RDU	14	47,610
NU4B	14	46,018
N2JNZ	7	28,531
KO1H	7	8,950
W8TM	7	5,671

SINGLE OP ASSISTED

K3WW	5,997,446
KI1G	5,076,994
W1US (K1LZ)	3,124,319
N8BJQ	2,065,621
AB2E	1,912,840
WF2B (K2ONP)	1,420,767
W8FJ	1,193,920
K3KO	1,181,160
AJ1I (W1EBI)	953,414
W2YC	707,644

MULTI-OPERATOR SINGLE TRANSMITTER

NO2R	6,969,490
NO5W	5,363,875
W4ML	4,216,734
NZ1U	4,106,418
KX7M	3,713,825
NØNI	2,829,631
WX6V	2,689,044
KE5C	787,203
NN6X	401,005
NB3O	186,588

MULTI-OPERATOR TWO-TRANSMITTER

KM4M	16,283,745
WE4OJ	8,248,032
WR3Z	5,790,164
NM7D	3,839,040
WX5S	3,788,934

MULTI-OPERATOR MULTI-TRANSMITTER

NY4A	14,703,940
NN5J	7,535,628
NG3U	1,742,460

*Low Power

CW & SSB CLUB COMPETITION

BAVARIAN CONTEST CLUB	**181,271,758**
POTOMAC VALLEY RADIO CLUB	**119,486,678**
ARAUCARIA DX GROUP	113,771,605
NORTHERN CALIFORNIA CONTEST CLUB	109,319,677
CONTEST CLUB FINLAND	97,773,937
YANKEE CLIPPER CONTEST CLUB	87,984,398
RHEIN RUHR DX ASSOCIATION	78,306,709
FRANKFORD RADIO CLUB	70,263,662
RUSSIAN CONTEST CLUB	65,875,706
FLORIDA CONTEST GROUP	63,037,217
SLOVENIA CONTEST CLUB	57,347,511
ATCC	53,896,890
URAL CONTEST GROUP	52,797,052
SOCIETY OF MIDWEST CONTESTERS	51,415,828
WORLD WIDE YOUNG CONTESTERS	46,240,508
YU CONTEST CLUB	45,461,140
LITHUANIAN CONTEST GROUP	43,229,420
CONTEST CLUB ONTARIO	40,999,978
KAUNAS UNIVERSITY OF TECHNOLOGY RADIO CLUB	37,865,490
CENTRAL SIBERIA DX-CLUB	36,253,730
LATVIAN CONTEST CLUB	35,911,814
SOUTHERN CALIFORNIA CONTEST CLUB	35,732,989
CHILTERN DX CLUB	34,080,000
TENNESSEE CONTEST GROUP	31,287,363
HA DX CLUB	25,489,664
CENTRAL TEXAS DX AND CONTEST CLUB	25,321,781
OKLAHOMA DX ASSOCIATION	25,259,063
BRITISH COLUMBIA DX CLUB	24,657,994
MAD RIVER RADIO CLUB	24,640,467
SOUTH EAST CONTEST CLUB	24,185,607
UKRAINIAN CONTEST CLUB	22,667,713
CROATIAN CONTEST CLUB	19,146,637
WESTERN WASHINGTON DX CLUB	18,473,998
SKY CONTEST CLUB	17,682,671
SAO PAULO CONTEST GROUP	17,145,054
TARTU CONTEST TEAM	16,484,855
SARAJEVO CONTEST GROUP	15,420,942
TIKIRRIKI CONTEST CLUB	14,912,853
LU CONTEST GROUP	14,249,314
GRAND MESA CONTESTERS OF COLORADO	14,186,228
NORTH COAST CONTESTERS	13,293,991
MARCONI CONTEST CLUB	12,991,186
SP DX CLUB	12,653,051
NORTH TEXAS CONTEST CLUB	12,550,749
EAST COAST CANADA CONTEST CLUB	11,993,666
CT RI CONTEST GROUP	11,604,197
BASHKORTOSTAN DX CLUB	11,416,017
ARUK	10,976,611
VRHNIKA CONTESTERS	10,969,878
MINNESOTA WIRELESS ASSOCIATION	10,688,523
LES NOUVELLES DX GROUP	10,083,686
GUARA DX GROUP	10,025,508
FOX CONTEST CLUB	9,368,718
KIEV CONTEST GROUP	9,106,909
TUPY DX GROUP	9,061,895
TOP OF EUROPE CONTESTERS	8,059,043
CZECH CONTEST CLUB	7,545,760
BLOEMFONTEIN AMATEUR RADIO CLUB	7,043,724
SP CONTEST CLUB	6,920,056
MOSCOW CONTEST CLUB	6,744,747
BELOKRANJEC CONTEST CLUB	6,383,648
BELARUS CONTEST CLUB	6,133,508
UNIVERSITY OF TOKYO CONTEST CLUB	4,613,803
WILLAMETTE VALLEY DX CLUB	4,404,643
NORTHERN GREECE CONTEST TEAM	4,077,776
KENTUCKY CONTEST GROUP	3,958,282
NCC	3,631,080
SRR	3,540,795
NORTHERN ILLINOIS DX ASSN	3,367,174
SARAJEVO CONTEST GROUP	3,277,930
KANSAS CITY DX CLUB	3,072,222
SOUTH GERMAN DX GROUP	2,896,612
GRUPO ARGENTINO DE CW (GACW)	2,881,164
YO DX CLUB	2,845,593
CENTRAL ARIZONA DX ASSOCIATION	2,749,390
SIAM DX GROUP	2,718,938
HUDSON VALLEY CONTESTERS & DX'ERS	2,696,920
SPOKANE DX ASSOCIATION	2,542,634
UNION FRANCAISE DES TELEGRAPHISTES (UFT)	2,310,375
Z30M CONTEST TEAM	1,966,337
CONTEST CLUB KRASNODARSKOGO KRAYA	1,408,013
AMSTERDAM DX CONTESTCLUB (ADXC)	1,381,802
CAROLINA DX ASSOCIATION	958,956
BERGEN AMATEUR RADIO ASSOCIATION (BARA)	788,973
ROCHESTER (NY) DX ASSN	722,616
ALRS SAINT-PETERSBURG	663,638
NORTHERN ROCKIES DX ASSOCIATION	641,534
LYNX DX GROUP	581,293
TEXAS DX SOCIETY	488,298
UDXC	482,020
NOVIO MAGUM CONTEST GROUP	411,117
ARCK	356,744
WEST PARK RADIOPS	224,696
VLADIMIR RADIOCLUB	58,405
CATALINA RADIO CLUB	46,920
CATALINA RADIO CLUB	46,920
TA3KC	11,530

Number groups after call letters denote following: Band (A = all), Final Score, Number of QSOs, and Prefixes. An asterisk (*) before a call indicates low power. Certificate winners are listed in boldface. (Note that the country names and groupings reflect the DXCC list at the time of the contest.)

CW RESULTS

QRP/p

OT4A	**A**	**1,161,126**	**1070**	**514**
			(Op: JK3GAD)	
OL4W	**A**	**875,805**	**1055**	**439**
			(Op: OK1IF)	
SM3C	**A**	**809,952**	**1051**	**472**
			(Op: SM5CCT)	
G3YMC	**A**	**600,544**	**856**	**392**
DF3AX	**A**	**592,644**	**777**	**393**
UA4ARL	**A**	**567,424**	**758**	**416**
LA5EKA	**A**	**453,222**	**691**	**378**
LY2ØØ4E	**A**	**446,886**	**786**	**366**
GW4ALG	**A**	**435,897**	**716**	**357**
OL3M	*	431,550	699	350
			(Op: OK1TGI)	
UU4J	**A**	**413,829**	**617**	**351**
			(Op: UU4JO)	
AN7AAW	**A**	**408,336**	**606**	**362**
GØDCK	*	390,942	662	333
F6FTB	**A**	**384,498**	**612**	**369**
ES6PZ	**A**	**336,644**	**618**	**308**
MØO	*	312,325	608	325
			(Op: G4JZO)	
LZ2BE	**A**	**237,726**	**466**	**281**
SM6CRM	*	202,356	373	308
7S3J	*	174,000	386	250
			(Op: SMØDZH)	
I1BAY	**A**	**170,478**	**332**	**246**
RU2FM	*	152,328	415	264
S56C	**A**	**148,092**	**361**	**246**
HB9DAQ	**A**	**145,130**	**330**	**230**
G4DBW	*	140,490	352	223
OZ6XR	**A**	**123,552**	**347**	**234**
UR8IDX	*	122,550	338	215
YO2CJX	**A**	**114,332**	**313**	**202**
DL1RNN	*	95,309	252	191
DL3KVR	*	90,943	256	199
SQ9QR	**A**	**65,567**	**209**	**173**
OK1FRY	*	63,674	192	158
HG8F	**A**	**63,336**	**220**	**182**
ON7CC	*	54,776	228	164
DL1LAW	*	52,824	241	142
IT9VDQ	**A**	**51,150**	**240**	**165**
UT7GX	*	47,610	165	138
RK1NA	*	46,008	200	142
GØWHO	*	44,829	198	153
RV3DBK	*	44,700	224	149
RV3GM	*	42,186	194	158
PA1B	**A**	**37,922**	**182**	**134**
DL9FBF	*	23,868	111	102
DF5RF	*	23,005	126	107
DJ5QK	*	21,909	201	109
OH6NPV	**A**	**17,384**	**125**	**106**
PAØRBO	*	11,880	108	88
UT5ERP	*	9,514	83	71
SM5DQ	*	7,749	72	63
SM6AHU	*	6,798	75	66
HB9AYZ	*	3,600	55	48
USØYA	*	3,264	35	32
DL3BVA	*	2,046	40	33
EA4OR	*	748	22	22
LA1PHA	*	16	4	4
EA7FNJ	**28**	**592**	**23**	**16**
SP9H	**21**	**152,048**	**365**	**272**
EW6CU	**21**	**111,230**	**314**	**245**
HAØGK	**21**	**34,300**	**155**	**140**
OK1AIJ	**21**	**18,920**	**126**	**110**
SM5ARR	**21**	**1,452**	**36**	**33**
RA3XEV	**21**	**800**	**20**	**20**
YT1CS	**14**	**503,010**	**683**	**414**
EU8RZ	**14**	**420,210**	**619**	**414**
HB9DAX	**14**	**335,232**	**505**	**388**
RW3AI	**14**	**211,888**	**434**	**323**
SP9NSV	**14**	**163,305**	**369**	**285**
OK1DSA	**14**	**149,668**	**367**	**284**
G3LHJ	**14**	**137,550**	**331**	**262**
DF5SF	**14**	**74,538**	**249**	**202**
SM5T	**14**	**19,376**	**123**	**112**
			(Op: SM5TSP)	
RU3RQ	*	13,950	106	93
I1/IT9LNH	**14**	**10,492**	**94**	**86**
IK2AIT/1	*	6,916	85	76
HA5DI	**14**	**5,700**	**63**	**60**
RV3YR	*	3,542	53	46
F/N7XY	**14**	**725**	**25**	**25**
OK1IR	**7**	**442,848**	**508**	**336**
LY5G	**7**	**402,880**	**524**	**320**
			(Op: LY2FE)	
T93W	**7**	**293,150**	**406**	**286**
SP4GFG	**7**	**280,224**	**410**	**278**
OH3BU	**7**	**259,272**	**378**	**277**
SM6EQO	**7**	**252,450**	**394**	**270**
OZ7BQ	**7**	**218,025**	**360**	**255**
YO6CFB	**7**	**156,450**	**317**	**210**
IK3VIA	**7**	**154,451**	**251**	**209**
ON6TJ	**7**	**105,776**	**207**	**176**
SM7/DL1BBO	*	71,725	217	151
ON4BHP	*	52,716	171	138
		(Op: LY2BHP@ON4BHP)		
UT5UQV	**7**	**15,192**	**77**	**72**
OH2BEC	*	3,567	44	41
OK2NA	*	1,431	28	27
RA3XAR	**3.5**	**45,000**	**161**	**120**
UA3LIZ	*	28,408	123	106
OK1NJC	**3.5**	**1,980**	**35**	**30**
SP9RQH	**3.5**	**1,711**	**32**	**29**
ON4AEB	**1.8**	**23,552**	**129**	**92**
RZ3VA	**1.8**	**13,832**	**90**	**76**
LY1BA	**1.8**	**11,270**	**83**	**70**
SO6A	**1.8**	**5,450**	**57**	**50**
			(Op: SP6IHE)	

SINGLE OPERATOR

UNITED STATES

KQ2M	**A**	**7,157,205**	**2681**	**855**
KT1V	**A**	**5,524,896**	**2239**	**741**
NU1P	**A**	**2,836,751**	**1537**	**667**
			(Op: K1MK @K1TTT)	
AK1W	*	1,941,576	1143	546
			(Op: K5ZD)	
WC1M	*	1,775,990	1057	527
K5MA	*	1,559,416	1018	491
W1GF	*	696,223	614	379
K1JB	*	357,210	407	294
NN1N	*	300,672	428	288
KC1XX	**14**	**3,861,778**	**1987**	**818**
			(Op: K1GQ)	
KG1D	**7**	**3,681,828**	**1339**	**657**
			(Op: K1KI)	
W1FJ	**3.5**	**271,860**	**344**	**230**
***NV1N**	**A**	**1,856,718**	**1216**	**549**
			(Op: N1UR)	
***WA1S**	**A**	**1,381,990**	**1177**	**565**
***WR1TE**	**A**	**652,589**	**670**	**371**
			(Op: W1JQ)	
***N3KCJ**	**A**	**527,022**	**558**	**342**
*K1HT	*	493,922	466	314
*KW1K	*	101,167	245	187
*W1VET	*	77,244	199	164
*KK1W	*	34,336	133	116
***K1BV**	**14**	**128,709**	**322**	**227**
*W1WEF	*	98,102	244	181
*W1OH	*	198	11	11
N2GC	**A**	**2,538,102**	**1429**	**623**
AK2P	**A**	**2,430,000**	**1423**	**675**
			(Op: W3MMM)	
KA2MGE	**A**	**532,508**	**567**	**382**
W2LE	*	385,096	448	296
W3BW	*	78,780	191	156
N2NC	**14**	**4,301,808**	**2075**	**826**
			(@N2RM)	
***N2MM**	**A**	**1,717,326**	**1104**	**537**
***WB2AA**	**A**	**1,352,574**	**1024**	**489**
***W2TZ**	**A**	**570,024**	**619**	**378**
*KNØWCW/2	*	518,408	603	344
			(Op: N2ED)	
*W2LK	*	340,034	385	274
*K2UF	*	321,198	400	282
*NW2J	*	203,984	354	244
*N2ZN	*	140,295	289	199
*W2EZ	*	119,798	286	199
*WA2VQV	*	98,784	216	196
*WA2BMH	*	77,578	183	158
*K2PS	*	64,200	200	150
*KY2T	*	50,337	168	141
*WA2BTR	*	2,898	44	42
*KV2M	*	840	21	21
*K2HT	*	765	17	15
*KV2X	*	120	10	10
***N2GM**	**21**	**120,840**	**255**	**212**
*KR2AA	*	12,994	79	73
***NT1E**	**7**	**897,230**	**685**	**415**
			(Op: K3BU)	
*K2TA	*	44,100	108	100
***WB2DVU**	**3.5**	**79,980**	**226**	**155**
KC3R	**A**	**6,047,565**	**2594**	**795**
			(Op: LZ4AX)	
K3ZO	**A**	**5,033,904**	**2031**	**744**
AA3B	**A**	**4,793,330**	**2133**	**745**
N3UM	*	1,917,272	1232	584
W3AZ	*	514,080	475	340
W4ZE	*	40,741	156	131
AI3Q	**14**	**252,000**	**366**	**288**
W3BGN	**7**	**2,186,042**	**995**	**514**
*K3STX	*	201,994	286	221
*KI3DS	*	5,772	62	52
*N3HS	*	848	16	16
***NJ3K**	**14**	**127,456**	**321**	**224**
*AAØCY	*	6,726	60	57
***W2CDO**	**3.5**	**11,484**	**77**	**66**
KN1DX	**A**	**5,863,530**	**2499**	**811**
			(Op: K4ZW)	
KK4TT	**A**	**5,270,539**	**2373**	**787**
			(Op: W4PA)	
KY4AA	**A**	**3,734,640**	**1971**	**756**
			(Op: N4GN)	
KT3Y	*	3,686,265	1615	677
WD4K	*	3,681,222	1970	762
			(Op: KØEJ)	
N2YO	*	3,429,343	1723	683
K4BAI	*	2,188,095	1507	637
AD4EB	*	1,261,050	1084	525
K4AMC	*	1,181,336	955	481
N3JT	*	1,107,293	825	473
K4LQ	*	1,023,223	751	457
W4BQF	*	1,018,354	977	479
WX4CW	*	696,784	767	407
			(Op: W4ARM)	
W4YE	*	665,340	607	390
W7QF	*	553,890	545	370
N4DW	*	406,973	492	329
N4TB	*	393,360	510	330
W2YE	*	292,248	405	264
W4NTI	*	257,439	396	273
WF3J	*	181,662	285	221
N4MM	*	135,136	239	206
KR4M	*	130,562	259	194
K4YKZ	*	96,068	192	146
AA3VA	*	7,332	61	52
NU4BP	**28**	**54,516**	**250**	**154**
			(Op: N4BP)	
K4OAQ	**21**	**704,700**	**752**	**435**
K1UM	**21**	**308,648**	**457**	**328**
W9WI	**14**	**1,472,618**	**1161**	**586**
NK4A	**7**	**2,813,692**	**1211**	**634**
			(Op: N4PN)	
NI1N	**7**	**1,765,125**	**955**	**523**
WW4LL	*	48,816	122	108
***WK2G**	**A**	**2,110,374**	**1452**	**567**
***N4IG**	**A**	**975,416**	**826**	**452**
***NA4K**	**A**	**478,254**	**597**	**354**
*AA4FU	*	407,040	541	320
*K4DJ	*	404,240	460	326
*KH2D	*	401,250	521	321
*KE1F	*	394,689	571	327
*K3WA	*	381,140	434	295
*WO4O	*	334,096	468	304
*WK4Y	*	283,195	384	271
*K1GU	*	281,124	404	274
*WW2DDM	*	271,425	389	275
			(Op: K4UK)	
*KI3O	*	187,839	369	243
*K4GKD	*	146,529	247	201
*K4IE	*	130,416	260	209
*NT4D	*	109,296	225	176
*W4BCG	*	103,104	244	192
*WX4TM	*	69,472	199	167
*KU3O	*	55,050	183	150
*AE4EC	*	36,519	148	111
*KE4OAR	*	27,976	124	104
*K4OGG	*	22,185	104	87
*W4AU	*	19,845	89	81
*K4FTO	*	13,206	79	71
*W4ZYT	*	9,765	64	63
*N4HXI	*	9,313	76	67
*K3MZ	*	8,748	54	54
*NY4N	*	6,300	65	60
*W2DZO	*	4,048	48	46
*W4KAZ	*	3,572	39	38
*KU8E/M	*	3,549	43	39
*K6ETM/4	*	1,100	20	20
***NA4W**	**28**	**53,284**	**232**	**154**
			(Op: K4WI)	
***KN4Y**	**28**	**28,910**	**161**	**118**
*KC4WQ	*	544	17	17
***WA1FCN**	**21**	**178,358**	**413**	**257**
*WB4TDH	*	51,744	185	154
*W3GRX	*	184	8	8
***KS4Q**	**14**	**237,690**	**354**	**285**
***KI4FDF**	**14**	**177,844**	**324**	**257**
*KI4EGT	*	101,504	259	208
*N5VI	*	25,960	123	110
***N4NX**	**7**	**438,400**	**393**	**320**
***K4SV**	**7**	**327,418**	**367**	**257**
NT5C	**A**	**3,878,901**	**2319**	**771**
			(Op: N3BB)	
WXØB	**A**	**3,512,712**	**2080**	**721**
			(Op: AD5Q)	
W5WMU	**A**	**2,260,626**	**1703**	**629**
WC5T	*	1,571,514	1258	527
			(Op: K5PI)	
NQ5K	*	359,466	764	331
			(Op: W5ASP)	
N5PU	*	183,222	327	243
NU5A	*	35,752	146	109
NN5AA	**28**	**145,625**	**415**	**233**
			(Op: K5NA)	
K2BA	**21**	**649,350**	**784**	**450**
W5FO	**14**	**1,357,590**	**1077**	**590**
KW5DX	*	604,467	725	423
			(Op: K1NT)	
***N5DO**	**A**	**1,285,353**	**1142**	**527**
***NI5F**	**A**	**243,390**	**415**	**266**
***K5SF**	**A**	**193,200**	**425**	**230**
*N5CRO	*	171,935	401	251
*AA5AU	*	150,400	363	235
*KØCIE	*	115,920	305	207
*AC5AA	*	109,804	262	194
*W5RW	*	65,790	232	153
*K5GM	*	41,040	147	120
*K5IB	*	28,674	139	118
*KC5LK	*	24,415	115	95
*WA5AAA	*	15,470	135	85
			(Op: K5KA)	
*NEØP	*	3,960	46	44
***NX5M**	**28**	**14,790**	**114**	**87**
***N5AW**	**21**	**224,361**	**391**	**291**
*KU5S	*	27,028	119	116
***NA5VY**	**14**	**8,004**	**78**	**69**
***K5RX**	**3.5**	**10,336**	**92**	**68**
AI6V	**A**	**4,056,096**	**2130**	**759**
			(@K6IDX)	
NE6N	**A**	**3,270,807**	**1960**	**687**
			(Op: N6RT)	
WA6O	**A**	**2,694,123**	**1850**	**641**
			(@N6RO)	
N6CW	*	2,001,144	1385	597
KF6RIP	*	1,792,240	1362	521
NG6O	*	1,626,764	1215	509
			(Op: WX5S)	
W4EF	*	1,556,434	1230	538
			(@W6UE)	
N6AA	*	1,316,812	1208	524
NZ6K	*	1,111,089	1078	471
			(Op: K6RB)	
N6NF	*	942,205	1009	463
W6TK	*	938,442	898	458
K6RIM	*	792,000	931	440
K6LRN	*	342,400	506	320
W6NKR	*	288,260	420	290
NI6T	*	220,074	421	258
NF6V	*	192,660	401	247
W6SJ	*	154,985	376	223
NW6P	*	132,046	299	206
W6OPO	*	80,808	217	168
WA6OGO	*	61,292	250	154
KE6ZSN	*	9,855	101	73
AJ6V	*	8,024	75	68
WA6BOB	*	5,661	60	51
NY6Y	*	666	19	18
WM6A	**14**	**495,330**	**677**	**395**
			(Op: K6TA)	
AC6DD	**7**	**1,191,528**	**843**	**402**
AB1U	*	35,504	129	112
			(Op: W6RKC)	
K6OY	**3.5**	**160,398**	**284**	**171**
WA5VGI/6	**3.5**	**159,272**	**299**	**172**
NT6K	*	101,592	265	153
***AA6PW**	**A**	**1,394,660**	**1245**	**509**
***N6HC**	**A**	**1,247,344**	**1185**	**518**
***WN6K**	**A**	**647,112**	**837**	**354**
*NC6CC	*	320,229	573	299
			(Op: N6ZFO)	
*WDØAVV	*	140,114	364	221
*N6EM	*	130,758	338	186
*KE6QR	*	54,600	195	150
*K6CSL	*	51,322	192	134
*K6RAD	*	24,856	124	104
*AE6NY	*	23,520	116	98
*KG6HAF	*	14,118	105	78
*KYØW	*	7,686	77	61
			(Op: W6ZZZ)	
*WB6NL	*	6,882	77	62
*KO6LU	*	5,768	80	56
***KU6T**	**7**	**10,956**	**68**	**66**
KN7NV	**A**	**2,628,120**	**1634**	**605**
			(Op: K7NV)	
WR7HE	**A**	**2,058,238**	**1521**	**602**
KN5H	**A**	**955,192**	**792**	**461**
			(Op: N3DXX)	
W7OM	*	505,274	583	374
N6HR/7	*	466,832	583	358
K7BG	*	389,918	611	331
W7QN	*	350,892	614	324
KO7X	*	300,793	588	313
KS7T	*	97,555	202	179
NR7DX	*	95,745	245	195
NI7R	*	83,592	206	172
W7LKG	*	50,440	160	130
KR7X	*	17,010	112	90
K7ZZ	**14**	**1,279,641**	**1163**	**561**
W7AYY	*	31,886	111	107
W7DPW	**3.5**	**527**	**18**	**17**
***N7WA**	**A**	**989,135**	**993**	**479**
***KUØW**	**A**	**476,982**	**722**	**363**
			(Op: NØAX)	
***AB7RW**	**A**	**205,088**	**405**	**272**
*KI7Y	*	200,692	407	262
*N7ZG	*	95,392	256	176
*KC7NUP	*	44,289	197	133
*N7EIE	*	32,643	188	117
*N7ZN	*	25,047	116	99
*N6KW	*	12,416	79	64
*K7TR	*	756	22	18
***K8IA**	**14**	**1,006,560**	**950**	**540**
*KU7T	*	82,894	242	191
*W7YS	*	8,442	72	67
***AA7FK**	**7**	**56,168**	**186**	**136**
*AE7DX	*	13,774	80	71
N8PW	**A**	**1,040,638**	**857**	**482**
K3JT	**A**	**964,355**	**885**	**467**
K8JQ	**A**	**587,366**	**715**	**377**
K2UOP	*	576,555	566	357
N4ZR	*	430,475	493	335
***KT8X**	**A**	**1,356,800**	**1158**	**530**
			(Op: W8MJ)	
***WB8TLI**	**A**	**537,280**	**545**	**365**
***K8IR**	**A**	**490,753**	**627**	**359**
*K8GT	*	158,592	299	224
*W8LU	*	150,381	303	217
*W8PN	*	97,704	248	177
*NF8M	*	41,820	161	123
*K8SAK	*	16,810	89	82
*KD8RB	*	15,486	103	89
*K8GVK	*	12,567	85	71
*KZ8E	*	5,289	45	43
*N9CX	*	984	24	24
***KV8Q**	**14**	**382,130**	**523**	**371**
***N8II**	**14**	**189,816**	**348**	**264**
KW9N	**A**	**6,698,560**	**2813**	**865**
			(Op: N9RV)	
W9OP	**A**	**1,141,924**	**886**	**476**
WA9IRV	**A**	**1,005,168**	**1061**	**487**
K9UQN	*	524,188	621	386
K9WWT	*	109,926	313	197
N9TK	**14**	**2,155,041**	**1392**	**711**
K9OM	**14**	**717,570**	**716**	**469**
K9CC	**7**	**377,872**	**537**	**304**
***KK9A**	**A**	**2,199,535**	**1450**	**685**
***KS9K**	**A**	**1,857,114**	**1219**	**578**
			(Op: N4TZ)	
***NE9U**	**A**	**1,009,944**	**968**	**468**
*K9YC	*	564,446	712	367
*AB9H	*	519,354	666	387
*WT9U	*	253,120	512	280
*W9LYA	*	72,816	228	164
*N9BOR	*	11,172	99	84
*W9AEM	*	1,800	25	24
*W9HR	*	867	17	17
***K9WA**	**21**	**31,742**	**140**	**118**
***K9QVB**	**14**	**1,076,920**	**929**	**545**
***K9BG**	**14**	**259,251**	**376**	**309**
*W9ILY	*	252,540	395	305
*WD9DZV	*	88,592	235	196
*KG9N	*	4,655	57	49
***K9WJU**	**7**	**95,524**	**200**	**167**
			(Op: W9CG)	
NØKE	**A**	**2,830,347**	**1711**	**663**
KU1CW	**A**	**1,756,625**	**1393**	**611**
NKØM	**A**	**814,506**	**770**	**462**
			(Op: KØDEQ)	
WØZP	*	574,062	905	397
WØHW	*	318,710	461	314
KØJPL	*	228,735	390	255
KØBX	*	24,220	80	70
KØCAT	**14**	**457,581**	**583**	**381**
			(Op: K9WIE)	
KØRAY	*	94,311	256	189
***KEØUI**	**A**	**322,792**	**539**	**314**
***NRØX**	**A**	**244,296**	**370**	**261**
***WY7AA**	**A**	**167,300**	**462**	**239**
			(Op: NØHF)	
*KØRWL	*	161,660	359	236
*KSØT	*	122,512	341	208
*KØHW	*	64,295	209	167
*WA2MNO	*	33,852	167	124

NORTH AMERICA

BARBADOS

***8P5A**	**A**	**9,034,060**	**3247**	**865**
			(Op: W2SC)	

CUBA

CO8TW	**A**	**26,037**	**107**	**99**

ALASKA

NL7G	**A**	**1,768,529**	**1144**	**541**

PUERTO RICO

***KP4JRS**	**14**	**3,570**	**36**	**34**
***NP3CW**	**A**	**2,080**	**29**	**26**

COSTA RICA

TI3M	**A**	**4,791,456**	**2432**	**786**
			(Op: TI3TLS)	

CANADA

VY2TT	**A**	**8,497,280**	**2864**	**880**
			(Op: K6LA)	
VE3EJ	**A**	**6,041,074**	**2436**	**793**
VE3DZ	*	4,965,558	2070	767
VE3MM	*	193,715	297	215
VE3OBU	*	1,140	20	20
VE3KZ	**28**	**8,550**	**61**	**57**
VE7UF	**21**	**186,560**	**377**	**220**
VC6X	**14**	**3,208,044**	**1824**	**724**
			(Op: VE6BF @ VE6JY)	
VE7XR	**14**	**1,961,166**	**1232**	**622**
VA3SY	**14**	**381,672**	**489**	**324**
VO1AU	**7**	**3,395,280**	**1150**	**564**
***VE3XB**	**A**	**1,451,331**	**1017**	**441**
***VE7XF**	**A**	**1,074,885**	**862**	**435**
*VE3KP	*	974,044	758	404
***VE1RGB**	**A**	**925,748**	**720**	**398**
*VE3XD	*	857,987	682	403
***VE2AWR**	**A**	**537,196**	**518**	**319**
*VA7LC	*	404,547	493	299
*VE1AWP	*	332,766	460	266
*VE3OM	*	269,620	347	260
*VE2XAA	*	168,544	261	184
*VA3XRZ	*	153,465	285	195
*VA7ST	*	144,495	306	169
*VA3UA	*	93,987	218	177
***VE5SF**	**A**	**81,528**	**236**	**158**
*VE2OWL	*	58,232	145	116
*VA3HUN	*	49,742	146	119
*VE5MX	*	39,098	164	113
***VO1MP**	**A**	**36,652**	**98**	**98**
*VA7CAB	*	12,936	90	56
*VE2FFE	*	10,266	70	58
*VE2DC	*	6,627	53	47
*VA7IRL	*	6,396	53	41
*VE3RCN	*	4,860	49	45
*VE3XAT	*	1,794	28	26
***VE3LBQ/F**	**21**	**37,240**	**192**	**133**
*VA3RJ	*	19,350	99	86
***VE2XAR**	**14**	**44,892**	**140**	**129**
***VE6RST**	**14**	**1,007,481**	**841**	**499**
			(Op: VO1CV)	
***VE3JAQ**	**14**	**292,584**	**381**	**292**
***VO1TA**	**14**	**199,360**	**311**	**224**
*VE6EX	*	185,110	419	214
***W7DRA/VC7**	**7**	**7,770**	**46**	**42**
***VE3MGY**	**1.8**	**14,418**	**72**	**54**

BERMUDA

***VP9/K1YR**	**A**	**1,750,359**	**1169**	**481**

MEXICO

XE1MM	**A**	**1,784,785**	**1450**	**491**
***XE1NW**	**A**	**607,696**	**653**	**304**
***XE3WAO**	**21**	**186,750**	**375**	**225**

CAYMAN IS.

ZF1A	**A**	**9,358,520**	**3058**	**860**
			(Op: K6AM)	

AFRICA

AFRICAN ITALY

IG9B	**7**	**5,187,819**	**1416**	**613**
			(Op: IV3NVN)	
*IG9/IV3TMV	*	125	5	5

TUNISIA

3V8BB	**A**	**13,765,728**	**3956**	**912**
			(Op: YT1AD)	

TANZANIA

***5I3A**	**21**	**3,005,952**	**1652**	**608**
			(Op: DL4SM)	

MADEIRA IS.

CS3B	**A**	**11,912,985**	**3534**	**885**
			(Op: CT1BOH)	
CT3KN	**A**	**5,864,082**	**2032**	**714**
***CT3KY**	**A**	**1,575**	**21**	**21**
***CT3KU**	**7**	**18,354**	**58**	**57**

CAPE VERDE

D4B	**A**	**16,619,000**	**4779**	**1000**
			(Op: 4L5A)	

CANARY IS.

EA8ZS	**14**	**20,336**	**84**	**82**
***EA8DA**	**A**	**5,520**	**42**	**40**
***EA8ASJ**	**14**	**511,550**	**526**	**325**
***EA8AVK**	**14**	**426,560**	**445**	**320**
*EA8NQ	*	342,700	386	298

ETHIOPIA

ET3TK	**7**	**905,032**	**461**	**332**

SOUTH AFRICA

ZS4TX	**A**	**6,964,140**	**2495**	**740**
***ZS4JAN**	**A**	**7,682**	**51**	**46**
***ZT6T**	**7**	**1,051,650**	**484**	**369**
			(Op: ZS6MG)	
***ZS6MG**	**3.5**	**1,683**	**18**	**17**

ASIA

AZERBAIJAN

***4K9W**	**A**	**838,530**	**650**	**363**

GEORGIA

4L8A	**14**	**5,322,216**	**2331**	**824**
***4L2M**	**A**	**1,866,900**	**1138**	**508**

SRI LANKA

4S7NI	**14**	**490**	**15**	**14**

ISRAEL

4Z5KJ	**A**	**283,167**	**312**	**219**
4X1VF	**28**	**487,326**	**492**	**287**
***4Z5MU**	**A**	**726,977**	**625**	**373**
***4Z5FW**	**21**	**1,065,000**	**900**	**426**
***4XØX**	**7**	**2,160,060**	**901**	**444**
			(Op: 4Z5AX)	
***4Z5LA**	**3.5**	**360,880**	**301**	**208**

CYPRUS

5B4AHA	**21**	**1,986,282**	**1322**	**549**
***5B4/OL8R**	**A**	**628,187**	**539**	**301**
			(Op: OK1FCJ)	

WEST MALAYSIA

9M2/G4ZFE	**A**	**3,403,260**	**2027**	**630**

SINGAPORE

9V1YC	**28**	**112,480**	**262**	**190**
***9V1GO**	**A**	**810,020**	**803**	**404**

OMAN

***A45WD**	**14**	**1,191,036**	**938**	**462**
			(Op: YO9HP)	

CHINA

***BA4DW**	**14**	**320,400**	**456**	**300**

CONTINENTAL LEADERS

AFRICA

1.8	No Entry	
3.5	*ZS6MG	1,683
7	IG9B	5,187,819
14	EA8ASJ	511,550
21	5I3A	3,005,952
28	No Entry	
AB	D4B	16,619,000

ASIA

1.8	JE1SPY	228
3.5	ZC4/G3AB	807,088
7	4XØX	2,160,060
14	4L8A	5,322,216
21	5B4AHA	1,986,282
28	4X1VF	487,326
AB	JH4UYB	4,976,315

EUROPE

1.8	HA8BE	293,388
3.5	S57AW	1,333,014
7	SN7Q	4,013,658
14	9A5W	4,443,300
21	YZ1AU	1,592,784
28	UUØA	389,064
AB	GI1A	7,476,080

NORTH AMERICA

1.8	VE3MGY	14,418
3.5	W1FJ	271,860
7	KG1D	3,681,828
14	N2NC	4,301,808
21	K4OAQ	704,700
28	NN5AA	145,625
AB	ZF1A	9,358,520

OCEANIA

1.8	No Entry	
3.5	VK2CZ	8
7	KH6ND	2,995,778
14	VK1AA/4	2,478,450
21	9M8DX	2,684,112
28	No Entry	
AB	9M6A	3,515,935

SOUTH AMERICA

1.8	No Entry	
3.5	*PR7AR	88,920
7	YV5OHW	2,746,107
14	PY2NY	2,287,584
21	PT5A	6,139,755
28	AYØF	1,920,402
AB	OC4WW	10,996,334

MULTI-OP, SINGLE TRANSMITTER

AF	No Entry	
AS	RT9W	10,997,918
EU	ED6IB	10,640,619
NA	VQ5V	12,951,027
OC	ZM1A	6,161,262
SA	P40O	19,456,480

MULTI-OP, TWO TRANSMITTER

AF	No Entry	
AS	No Entry	
EU	RU1A	12,502,208
NA	KM4M	16,283,745
OC	4D2X	1,024,797
SA	PJ4U	17,502,264

MULTI-OP, MULTI-TRANSMITTER

AF	No Entry	
AS	A61AJ	35,088,914
EU	DL8WPX	18,949,707
NA	NY4A	14,703,940
OC	ZL6QH	16,143,840
SA	No Entry	

Low Power

KYRGYZSTAN

EX2A	**A**	**1,124,650**	**832**	**415**
EX8O	**A**	**115,839**	**273**	**183**
***EX2X**	**A**	**1,672,215**	**1165**	**555**
***EZ4XX**	**A**	**1,492,340**	**877**	**415**

SOUTH KOREA

HL5UOG	**A**	**451,656**	**577**	**328**
DS1CCU	**A**	**60,984**	**200**	**121**
6K2AVL	**7**	**1,099,273**	**760**	**371**
***HL1/WX8C**	**A**	**469,566**	**610**	**342**
***HL2FDW**	**A**	**199,916**	**458**	**212**
*DS5KJR	*	109,394	309	166
*HL5AP	*	45,360	179	140
*HL2SOQ	*	30,361	122	97
***HL2/JH1FXF**	**21**	**14,430**	**151**	**78**
***DS2QJS**	**14**	**925,566**	**880**	**437**
			(Op: N1MM)	

THAILAND

HSØZDY	**21**	**207,240**	**391**	**264**
***HSØAC**	**A**	**2,090,529**	**1467**	**567**
			(Op: E21EIC)	
***HSØZDZ**	**A**	**1,048,581**	**929**	**443**
***HS8KAY**	**14**	**425**	**17**	**17**
*HSØEHF	*	364	14	13

JAPAN

JH4UYB	**A**	**4,976,315**	**2112**	**727**
8J1ITU	**A**	**3,016,250**	**1644**	**625**
JH3AIU	**A**	**2,703,212**	**1539**	**622**
JH1EAQ	*	1,974,720	1196	528
JA1JKG	*	1,197,468	830	444
JH7XGN	*	1,091,400	869	428
JA2AXB	*	335,688	405	284
JA1HP	*	271,183	417	277
JF9JTS	*	250,444	359	254
JA1QOW	*	243,552	358	236
JA5FBZ	*	109,228	205	166
JR3XEX	*	96,216	241	152
JA3DAY	*	56,032	154	136
JL1LNC	*	44,824	146	104
JR3NZC	*	37,026	125	99
JR3UIC	*	21,097	83	73
7J1ABD	*	15,257	85	73
JA1FBH	*	14,256	103	66
JA6TMU	*	12,420	74	69
JL4LWL	*	6,716	49	46
JA7NVF	**21**	**396,880**	**506**	**328**
JS1DCZ	*	1,674	34	31
JF2FIU	*	126	8	7
JA6GCE	**14**	**2,406,554**	**1420**	**629**
JA5APU	**14**	**768,096**	**688**	**432**
JA9CWJ	*	42,408	126	124
JQ2EHD	*	26,730	104	99
JA1VJQ	**7**	**654,033**	**453**	**311**
JH7XMO	**7**	**495,558**	**404**	**266**
JO7KMB	*	110,408	195	148
JS1PWV	*	65,403	142	117
JA5IP	*	50,898	112	102
***JH2NWP**	**A**	**1,144,731**	**829**	**453**
***JA2KVB**	**A**	**713,592**	**579**	**408**
***JA1RKI**	**A**	**471,534**	**519**	**327**
*JA1CP	*	302,260	408	254
*JL3SIK	*	257,000	358	257
*JG3LGD	*	239,343	330	221
*JA2IU	*	239,076	348	261
*JA1CJP	*	205,332	300	213
*JF1NHD	*	167,458	355	202
*8N3KAN/3	*	166,500	318	222
*JA6BGA	*	131,211	230	183
*JE1UKM	*	124,709	255	181
*JA2VZL	*	103,180	224	154
*JAØBMS	*	94,080	224	168
*JJ6TWQ	*	93,002	200	146
*JA7BME	*	90,012	191	156
*JA6SRB	*	89,076	189	156
*JA4AQR	*	88,578	194	171
*JA1XPU	*	86,565	222	145
*JA1HTG	*	82,104	208	132
*JO1QZI	*	61,480	126	106
*JA2PFO	*	55,775	158	115
*JM1GHT	*	53,400	156	120
*JE1RRK	*	52,030	153	121
*JH3JYS	*	48,941	141	109
*7J1AIL	*	42,840	147	126
*JA1HG	*	40,600	123	100
*JM4WUZ	*	34,668	124	107
*JM2RUV	*	34,230	115	105
*JAØXZD	*	26,226	107	94
*7N4CLI	*	25,491	103	87
*JA2QVP	*	23,822	97	86
*JI4JGD	*	22,995	88	73
*JO3AGQ	*	21,321	82	69
*JA3AVO	*	13,200	65	60
*JH1WFK	*	12,709	79	71
*JA1IZ	*	10,353	59	51
*JJ4PPK	*	8,642	61	58
*JHØSGG	*	7,473	51	47
*JE1JAC	*	6,880	48	43
*JF7GDF	*	5,856	50	48
*JR1UMO	*	3,955	36	35
*JA5MOO/8	*	3,552	48	37
*JA3RUA	*	3,234	36	33
*JG1FGL	*	2,924	36	34
*JM6NJU	*	16	4	4
***JF3BFS**	**28**	**4,128**	**52**	**43**
***JE2SOY**	**28**	**1,170**	**27**	**26**
*7K2PBB	*	912	30	24
*JA1AAT	*	91	8	7
***JA1BPA**	**21**	**88,784**	**198**	**179**
*JG3EHD	*	377	13	13
*JQ1AHZ/2	*	273	13	13
***JH1AZO**	**14**	**442,144**	**528**	**337**
***JHØEPI**	**14**	**226,653**	**355**	**251**
*JR4GPA	*	194,350	315	230
*JR5NMD	*	16,646	83	82
*JN7NSV	*	11,718	73	54
*JJ1JRH	*	625	25	25
***JL6IPK**	**7**	**31,684**	**111**	**89**
*JA1PS	*	1,620	18	18
*JO3LDN	*	18	3	3
***JM1NKT**	**3.5**	**5,544**	**44**	**36**
*JA1VVH	*	196	8	7
***JE1SPY**	**1.8**	**228**	**19**	**12**

ASIATIC TURKEY

***TA3BN**	**A**	**105,648**	**207**	**142**
***TA3DD**	**7**	**2,147,200**	**866**	**440**

ASIATIC RUSSIA

RA9SG	**A**	**4,706,565**	**1992**	**645**
UA9SP	**A**	**2,342,736**	**1274**	**493**
RV9XM	**A**	**2,227,992**	**1220**	**481**
UA9KM	*	1,376,388	894	442
UA9APA	*	1,251,074	787	418
UA9CLB	*	665,496	620	324
RV9XO	*	444,193	427	289
RA9ST	*	428,544	456	248
RL9FYL	*	296,647	406	247
			(Op: UA9FM)	
UA9FM	*	217,280	344	224
RV9UD	*	92,736	220	168
RZ9OQ	**14**	**1,432,200**	**988**	**550**
RA9JM	**14**	**403,216**	**498**	**319**
UA9HR	*	189	9	9
RK9AWT	**7**	**1,376,298**	**685**	**378**
			(Op: RX9AF)	
***RU9CI**	**A**	**1,668,992**	**1033**	**472**
***RA9XF**	**A**	**1,087,200**	**829**	**400**
***RK9CR**	**A**	**844,245**	**678**	**365**
*UA9FGJ	*	663,762	575	339
*UA9OA	*	404,700	426	285
*RW9MD	*	386,610	457	294
*UA9XMB	*	315,350	324	238
*RA9JG	*	296,478	367	273
*UA9OUU	*	288,611	431	257
*RX9FB	*	218,020	282	220
*RV9CLF	*	144,153	237	171
*UA9CR	*	129,584	226	182
*UA9MQR	*	127,090	238	179
*UA9OV	*	52,151	155	121
*RU9UG	*	35,815	103	95
*RA9UN	*	14,326	68	58
*RX9WN	*	11,844	71	63
***UA9AFS**	**21**	**316,535**	**403**	**295**
***RA9DZ**	**14**	**1,117,872**	**816**	**504**
***UA9LAO**	**14**	**1,069,453**	**805**	**473**
*UA9JLL	*	864,576	690	456
*RA9XU	*	413,127	491	321
*UA9OFF	*	349,866	446	279
*RA9JR	*	211,265	331	235
*RA9KM	*	139,932	250	207
*RX9JW	*	47,385	145	117
*RW9SZ	*	47,000	144	125
*UA9LAC	*	28,365	113	93
*RA9AC	*	23,220	98	86
*UA9QCP/3	*	19,845	87	81
*RW9QA	*	660	16	15
RTØQ	**A**	**3,504,096**	**1746**	**736**
			(Op: RZ3BY/Ø)	
UAØACG	**A**	**957,564**	**787**	**397**
RUØLL	*	112,160	379	160
UAØAGI	*	25,536	114	96
RAØBA	**14**	**1,056,354**	**856**	**457**
UAØAZ	**14**	**461,010**	**460**	**363**
RWØAJ	**3.5**	**62,348**	**129**	**109**
***RUØAW**	**A**	**1,579,711**	**999**	**491**
***RUØSN**	**A**	**591,570**	**615**	**378**
***RAØAA**	**A**	**227,128**	**374**	**232**
*RAØSDW	*	80,661	244	167
*UAØAKY	*	30,900	115	100
*RAØJX	*	24,119	120	89
*RAØALM	*	8,760	62	60
***UAØSAD**	**14**	**507,990**	**531**	**354**
*RUØAT	*	59,976	171	136
***UAØFDX**	**7**	**63,952**	**167**	**112**

UZBEKISTAN

UK/JI2MED	**A**	**1,231,650**	**1049**	**450**

KAZAKHSTAN

UP1G	**A**	**2,647,392**	**1631**	**528**
			(Op: UN7QX)	
UN8GV	**A**	**2,238,618**	**1437**	**538**
UN6G	**A**	**1,496,792**	**994**	**466**
UN5J	*	172,800	312	216
UN6LN	**14**	**699,648**	**674**	**384**
***UN7MO**	**A**	**2,955,810**	**1446**	**583**
***UP6P**	**A**	**1,089,504**	**812**	**388**
***UN4PD**	**21**	**233,376**	**346**	**264**
***UN4PG**	**14**	**218,112**	**320**	**256**

HONG KONG

VR2BG	**A**	**2,581,475**	**1719**	**611**

INDIA

***VU2UR**	**A**	**32,110**	**109**	**95**

UK BASES ON CYPRUS

ZC4/G3AB	**3.5**	**807,088**	**482**	**292**

EUROPE

ITU GENEVA

4U1VIC	**7**	**2,411,288**	**1474**	**583**
			(Op: JH4RHF)	

CROATIA

9A4KW	**A**	**894,208**	**984**	**499**
9A7V	**A**	**498,940**	**615**	**380**
9A2HQ	*	50,568	164	147
9A7R	**21**	**1,083,644**	**1075**	**556**
9A5W	**14**	**4,443,300**	**2319**	**900**
9A8A	**14**	**3,873,424**	**2150**	**872**
9A5ABO	**3.5**	**545,280**	**655**	**355**
***9A4RC**	**A**	**1,682,908**	**1455**	**548**
***9A3SM**	**A**	**390,600**	**601**	**372**
*9A5AEI	*	97,664	310	224
*9A8MM	*	23,296	144	112
***9A3VM**	**28**	**184,402**	**567**	**274**
***9A6C**	**21**	**973,056**	**1134**	**543**
***9A3RE**	**1.8**	**69,237**	**234**	**147**

MALTA

***9H3MM**	**A**	**4,647,705**	**3192**	**809**
			(Op: DF4SA)	

PORTUGAL

CS6T	**7**	**1,778,007**	**1822**	**537**
			(Op: CT1ILT)	
***CT1AOZ**	**28**	**35,644**	**196**	**134**
***CT4DX**	**14**	**81,216**	**216**	**216**

GERMANY

DL3TD	**A**	**5,116,545**	**2603**	**777**
DL3YBM	**A**	**4,347,593**	**2365**	**761**
DL5YM	**A**	**1,985,862**	**1516**	**606**
DF1LON	*	1,549,260	1311	570
DJ9RR	*	1,219,914	1263	522
DL1NEO	*	1,185,052	1127	506
DL7JAN	*	1,181,256	1243	498
DL1DTC	*	1,104,065	1064	527
DL3AMA	*	788,082	1035	446
DL6AG	*	542,340	685	393
DF8AA	*	451,264	592	352
DJ5MW	*	200,634	442	281
DJ7LH	*	191,262	386	254
DL3JPN	*	146,718	324	247
DL7VAF	*	114,886	245	218
DK3YD	*	113,454	289	198
DJ9HX	*	100,380	231	210
DK4YJ	*	98,564	228	164
DJ5IW	*	57,255	185	165
DL5RBR	*	57,078	184	151
DL5ANS	*	693	21	21
DK2GZ	**21**	**735,505**	**881**	**509**
DL5JS	**21**	**303,356**	**538**	**362**
DK2OY	**14**	**1,887,100**	**1489**	**668**
DK3KD	**14**	**1,309,878**	**1182**	**573**
DL6RAI	**7**	**2,483,250**	**1196**	**602**
DN2AA	**7**	**2,165,387**	**1311**	**581**
DJ6BQ	**7**	**1,036,194**	**887**	**463**
DM3XRF	*	728,775	679	395
DL9NEI	**3.5**	**199,044**	**346**	**228**
***DL2OBF**	**A**	**2,153,088**	**1732**	**623**
***DL7BY**	**A**	**1,608,922**	**1292**	**574**
***DL4SDW**	**A**	**1,323,384**	**1154**	**536**
*DL5KUD	*	971,226	1010	474
*DL1NKS	*	664,202	743	418
*DJ5GG	*	503,496	716	378
*DL3ZAI	*	379,341	590	373
*DK3WW	*	370,500	532	375
*DL5CD	*	297,160	525	323
*DL1DSW	*	293,550	481	309
*DL8UNF	*	292,020	500	310
*DJ8UV	*	277,530	474	319
*DJ3JD	*	275,352	512	308
*DL1SAN	*	255,794	499	302
*DL8UKE	*	190,242	412	271
*DL8UFO	*	172,550	311	290
*DL1YFF	*	154,488	338	246
*DL3MCO	*	137,445	322	231
*DJ4EJ	*	136,640	370	244
*DL6RBH	*	132,012	337	228
*DL9ABM	*	123,170	304	226
*DM3PKK	*	99,879	258	197
*DG2MIC	*	93,730	285	206
*DL5SWB	*	83,636	288	203
*DH4SBO	*	81,732	252	196
*DK9IP	*	74,128	200	164
*DL5NDX	*	72,962	225	191
*DK5ZX	*	64,064	196	154
*DK8AX	*	52,682	175	142
*DL5KUR	*	51,460	180	166
*DJ6UP	*	41,292	181	148
*DL4NT	*	37,392	150	123
*DL8DWW	*	28,980	121	105
*DL7RBI	*	23,246	120	118
*DL1EFO	*	19,596	99	92
*DL8UVG	*	11,008	100	86
*DL4AAE	*	10,098	71	66
*DL9OT	*	4,144	38	37
*DK8NI	*	3,822	59	49
*DK7AN	*	3,520	38	32
*DL1ARD	*	2,232	38	36
*DH5HV	*	184	9	8
***DL3BRA**	**21**	**61,235**	**229**	**185**
*DJ6TK	*	40,506	174	157
*DL8ZAJ	*	13,572	92	87
*DL1FMG	*	13,020	111	93
***DL1TH**	**14**	**215,450**	**403**	**310**
***DL6UAA**	**7**	**346,935**	**418**	**303**
*DL3EBX	*	299,425	390	295
*DF9ZP	*	263,526	361	263
*DL7UIO	*	81,440	193	160
***DF1IAQ**	**1.8**	**12,110**	**86**	**70**

SPAIN

AN5FV	**A**	**3,913,785**	**2671**	**795**
EA1JO	**A**	**625,530**	**810**	**435**
AM1AEH	**A**	**91,857**	**369**	**201**
EA3FM	*	1,876	29	28
***AM4BBH**	**A**	**1,692,408**	**1589**	**604**
			(Op: EA4DRV)	
***EA7TG**	**A**	**1,650,864**	**1381**	**633**
***EA2BNU**	**A**	**400,911**	**604**	**357**
*EA5EOH	*	152,750	326	235
*EA1AK/7	*	135,296	321	224
*EA7CA	*	111,302	264	202
*EA2AZ	*	110,776	330	227
*AM7MT	*	94,710	267	205
*EA7CWA	*	74,970	214	170
*EA1VM	*	40,820	153	130
*EA3ALZ	*	21,420	114	105
*EA3AXM	*	14,536	107	92
*EA3AVV	*	7,685	57	53
*EA4IE	*	6,710	59	55
*EA4AYD	*	3,404	40	37
*EA4BNQ	*	144	12	12
***AM7KJ**	**21**	**167,596**	**414**	**293**
***EA1ND**	**14**	**25,894**	**140**	**121**
***AN7WA**	**7**	**1,416,882**	**940**	**479**
*EA5DCL	*	200,928	270	224
***AM3AKY**	**3.5**	**277,344**	**404**	**288**

BALEARIC IS.

EA6AZ	**A**	**3,520**	**51**	**44**

IRELAND

***EI4DW**	**A**	**287,053**	**494**	**311**
***EI7JK**	**A**	**135,595**	**346**	**235**
***EI9JN**	**14**	**23,184**	**123**	**112**
***EI4CF**	**3.5**	**80,640**	**197**	**168**

MOLDOVA

***ER3ZZ**	**A**	**67,124**	**193**	**173**
***ER3DX**	**A**	**61,880**	**167**	**140**
***ERØFEL**	**14**	**463,896**	**697**	**408**
			(Op: UR5FEL)	
*ER5AG	*	282,656	491	352

ESTONIA

ES5TV	**A**	**3,724,084**	**2504**	**787**
ES6Q	**14**	**1,948,118**	**1505**	**698**
			(Op: ES5MC)	
***ES4MM**	**A**	**125,609**	**295**	**209**
***ES1CN**	**21**	**78,793**	**255**	**209**
***ES2EZ**	**7**	**390,927**	**506**	**311**
***ES5JR**	**3.5**	**105,265**	**267**	**185**

BELARUS

EW1CQ	**A**	**1,177,498**	**1081**	**557**
EW3LN	**A**	**569,160**	**625**	**372**
EW7KR	*	106,974	293	189
EU1DX	**14**	**1,155,731**	**1151**	**577**
EW6AF	*	99,008	300	221
EW7LO	**7**	**296,751**	**395**	**273**
EU1AZ	**3.5**	**674,304**	**761**	**384**
EW8DX	*	181,440	347	224
***EU2MM**	**A**	**882,519**	**985**	**517**
***EU4CQ**	**A**	**69,360**	**219**	**170**
*EW6MM	*	22,148	134	113
***EW6DX**	**28**	**24,380**	**198**	**106**
***EU1SA**	**21**	**347,382**	**585**	**378**
***EU6DX**	**14**	**401,154**	**598**	**417**
***EV6M**	**1.8**	**95,842**	**258**	**173**

FRANCE

TM9C	**A**	**2,495,670**	**1804**	**615**
			(Op: F5IN)	
F5NQL	**A**	**829,271**	**915**	**439**
F5CQ	*	435,051	547	369
F8DGF	*	21,423	119	111
TM9R	**21**	**1,217,304**	**1294**	**583**
			(Op: F6IRA)	
TM6X	**14**	**3,047,084**	**2029**	**772**
			(Op: F5VHY)	
F5NBX	**3.5**	**684,613**	**647**	**359**
***F/DL5XL**	**A**	**324,762**	**610**	**339**
***F5SGI**	**A**	**250,480**	**486**	**310**
*F8BTR	*	249,964	496	286
*F5INJ	*	122,265	315	209
*F8DFP	*	102,466	249	182
*F6CZV	*	51,100	181	140
*F6DZD	*	32,640	192	136
*F5RPB	*	21,527	111	103
***F5JY**	**21**	**176,715**	**357**	**297**

ENGLAND

G3XTT	**A**	**3,462,030**	**2263**	**715**
GØMTN	**A**	**2,104,395**	**2072**	**587**
G4WFQ	*	212,432	373	272
G3TXF	*	31,290	119	105
G4BJM	*	29,003	116	97
***G3RXP**	**A**	**1,249,395**	**1245**	**511**
***G5W**	**A**	**716,870**	**964**	**418**
			(Op: GØWAT)	
***G4KFT**	**A**	**580,890**	**745**	**402**
*G3KKQ	*	508,254	792	381
*G4BUE	*	489,072	605	368
*G4GOY	*	425,826	663	369
*MØCCE	*	415,360	1180	352
*G3OOU	*	409,617	699	351
*GØUKX	*	272,008	507	281
*GØMRH	*	28,542	167	134
*G6OKU	*	20,496	128	112
*G4EMT	*	1,118	27	26
*2E1OKT	*	176	12	11
***G3RSD**	**21**	**76,670**	**264**	**205**
***G3ZRJ**	**14**	**554,931**	**719**	**459**
***M3C**	**14**	**492,855**	**851**	**435**
			(Op: GØVQR)	
***G4ZOB**	**7**	**378,176**	**390**	**304**

NORTHERN IRELAND

GI1A	**A**	**7,476,080**	**3566**	**904**
			(Op: MØSDX @ GIØKOW)	

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MI6X	*	85,498	232	197
			(Op: GI4FUE)	
***GI4KSH**	**A**	**242,703**	**405**	**303**

JERSEY

***MJØASP**	**A**	**68,056**	**206**	**188**

SCOTLAND

GM4SID	**A**	**809,804**	**1028**	**457**
GM2Z	**A**	**654,432**	**1149**	**401**
			(Op: MMØDFV)	
MMØDFV	*	7,452	90	69
***GM3CFS**	**21**	**167,774**	**384**	**298**

GUERNSEY

***MUØFAL**	**A**	**522,248**	**714**	**388**

WALES

GW3NJW	**21**	**512,239**	**921**	**433**
***MWØGMB**	**A**	**21,276**	**130**	**108**
***GW3KJN**	**7**	**141,040**	**252**	**205**

HUNGARY

HA8DU	**A**	**4,180,715**	**2241**	**741**
HG8R	**A**	**4,101,084**	**2355**	**762**
HA3LI	**A**	**2,625,456**	**1816**	**664**
HA3PT	*	902,265	992	455
HG8Z	**28**	**73,566**	**292**	**201**
HG3IPA	**21**	**246,449**	**505**	**323**
HG3M	**14**	**3,024,648**	**1971**	**792**
			(Op: HA3MY)	
HA9PP	**14**	**2,598,781**	**1727**	**757**
HA8BE	**1.8**	**293,388**	**478**	**276**
***HA1SN**	**A**	**72,861**	**216**	**163**
***HA1ZZ**	**28**	**90,936**	**343**	**216**
***HG6V**	**14**	**1,220,704**	**1142**	**592**
			(Op: HA6IAM)	
***HG2ØØ4HUN**		**14**		
800,748		**962**		
531				
			(Op: HA1CW)	
*HA8MD	*	625,959	893	443
*HA2MN/5	*	133,030	300	251
***HG8I**	**7**	**1,552,320**	**1054**	**584**
*HA5W	*	428,465	490	335
***HA4FV**	**3.5**	**262,542**	**448**	**266**
***HA9SU**	**1.8**	**10,725**	**81**	**65**

SWITZERLAND

***HB9ARF**	**A**	**762,570**	**913**	**458**
***HB9HQX**	**A**	**180,000**	**377**	**240**
*HB9DOZ	*	23,638	129	106
*HB9CZF	*	9,301	75	71
***HB9/OM3CGN**	**14**	**1,172,808**	**1084**	**546**

ITALY

IR4T	**A**	**6,409,400**	**3005**	**878**
IR2C	**A**	**1,750,509**	**1299**	**603**
			(Op: IK2JUB)	
IK2UCK	**A**	**1,277,430**	**1361**	**553**
IK2SND	*	654,696	728	378
IZ1DXS	*	20,203	98	89
IK1QBT	**21**	**497,080**	**716**	**430**
IKØYUT	**14**	**1,720,355**	**1315**	**665**
IKØYVV	*	235,956	480	318
IU3X	**7**	**3,060,540**	**1419**	**630**
			(Op: IV3SKB)	
I2IFT	**7**	**1,725,398**	**1170**	**527**
IV3RLB	*	273,088	380	251
IZ1GAR	**3.5**	**386,130**	**544**	**305**
***IK2NUX**	**A**	**195,990**	**378**	**278**
***I2AZ**	**A**	**193,648**	**401**	**266**
***IZ8DVD**	**A**	**120,744**	**282**	**216**
*I6FDJ	*	72,450	232	175
*IK2NCF	*	55,909	208	163
*IZ2EID	*	49,445	180	145
*IZ4DYX	*	33,669	156	129
*IV3KSE	*	16,074	102	94
*IV3DYS	*	14,790	94	85
*IK7FMQ	*	10,880	88	80
***IR8C**	**28**	**49,063**	**281**	**163**
			(Op: IZ8EQF)	
***IØQM**	**21**	**19,776**	**104**	**103**
***I1NVU**	**14**	**412,644**	**610**	**411**
*IZØBXZ	*	49,590	212	171
*IZ3ESV	*	32,718	147	114

SARDINIA

ISØ/S52A	**A**	**3,854,228**	**2354**	**769**
***ISØUWX**	**14**	**22,876**	**137**	**125**
			(Op: S59AA)	

SICILY

IU9S	**14**	**3,126,487**	**2133**	**799**
			(Op: IT9BLB)	
***IT9ORA**	**A**	**417,646**	**705**	**367**
*IT9AJP	*	132,720	302	237
***IU9AF**	**28**	**20,844**	**163**	**108**
***IT9GXE**	**21**	**6,890**	**72**	**65**

SVALBARD

***JW3R**	**A**	**217,899**	**428**	**279**
			(Op: LA5LJA)	

NORWAY

LN8W	**A**	**4,325,352**	**2987**	**787**
			(Op: LA8SDA)	
***LG5LG**	**A**	**707,535**	**973**	**405**
			(Op: DL3KWF)	
*LA7SI	*	39,192	180	138
***LA7AK**	**3.5**	**334,058**	**492**	**298**
*LA3BO	*	211,000	390	250

LITHUANIA

LY2MM	**A**	**1,436,842**	**1257**	**542**
LY2PX	**A**	**839,670**	**1258**	**390**
LY2DX	*	262,818	391	279
LY3BU	*	231,434	418	271
LY2IJ	**14**	**2,785,980**	**1754**	**787**
LY2BBF	*	3,854	48	47
LY2KM	**7**	**251,856**	**336**	**264**
LY2TE	**3.5**	**368,030**	**550**	**298**
LY2BW	**1.8**	**262,615**	**444**	**265**
***LY2KW**	**A**	**368,202**	**647**	**327**
***LY1BX**	**A**	**222,508**	**458**	**286**
***LY2LF**	**A**	**216,720**	**409**	**252**
*LY2OC	*	187,050	452	258
*LY2BOS	*	179,750	389	250
*LY3CY	*	147,392	299	224
*LY2OM	*	107,540	259	190
*LY2BNL	*	60,900	196	140
*LY1CT	*	1,152	24	24
***LY9A**	**14**	**1,623,410**	**1397**	**670**
			(Op: LY3BA)	
***LY2AT**	**7**	**213,614**	**333**	**254**
***LY3CW**	**3.5**	**418,931**	**590**	**323**
*LY2FF	*	31,692	134	114
***LY5A**	**1.8**	**189,154**	**385**	**229**
***LY2OU**	**1.8**	**117,486**	**306**	**183**
*LY4BF	*	48,128	180	128
*LY2GW	*	42,875	170	125

BULGARIA

LZ1V	**14**	**1,807,800**	**1500**	**690**
			(Op: LZ3FM)	
LZ2PL	*	726,045	865	485
LZ2L	**3.5**	**628,544**	**677**	**368**
			(Op: LZ2LDS)	
***LZØ4KM**	**A**	**1,971,162**	**1700**	**633**
			(Op: LZ3YY)	
***LZ1QV**	**A**	**487,227**	**582**	**403**
***LZ1AQ**	**A**	**479,997**	**681**	**401**
*LZ1ZM	*	315,552	542	304
*LZ5PL	*	49,284	194	148
*LZ4BU	*	19,980	99	90
*LZ1FJ	*	42	6	6
***LZ1EP**	**14**	**160,020**	**410**	**297**
*LZ1MC	*	57,600	216	180
*OH2LO	*	18,988	114	101
*OH2J	*	9,471	96	77
			(Op: OH2OT)	
***OH6BG**	**14**	**955,900**	**1102**	**550**
*OH6RC	*	75,144	232	202

ALAND IS.

OHØB	**A**	**4,716,978**	**2923**	**798**
			(Op: OH2UA)	
OHØV	**21**	**1,450,608**	**1512**	**643**
			(Op: OH6LI)	
***OHØEC**	**A**	**1,389,484**	**1474**	**563**
			(Op: DL1EKC)	

CZECH REPUBLIC

OL5Y	**A**	**2,830,750**	**1898**	**670**
OLØW	**A**	**2,530,440**	**1790**	**660**
			(Op: OK1DSZ)	
OK8YD	**A**	**2,387,232**	**1902**	**648**
			(Op: DL1YD)	
OK1EP	*	1,944,320	1611	620
OK2PDT	*	1,492,920	1390	572
OK2EQ	*	1,091,072	1076	512
OK1AYY	*	519,632	674	376
OK2ABU	*	500,050	637	365
OL7X	**21**	**80,145**	**241**	**195**
OK1FIA	**14**	**733,122**	**783**	**482**
OK2BVG	**7**	**7,344**	**36**	**34**
OK1RR	**3.5**	**710,328**	**692**	**408**
*OK2PBG	*	110,201	231	173
*OK2BND	*	103,320	279	205
*OK2QX	*	101,689	274	199
*OK1FCA	*	99,586	242	202
*OK1DOR	*	60,928	172	136
*OK1BLU	*	56,052	200	173
*OK2CLW	*	12,600	108	84
*OK1AKB	*	7,500	70	60
*OK2BJ	*	7,128	50	44
***OK2HZ**	**28**	**30,915**	**189**	**135**
***OK2BGK**	**28**	**26,624**	**168**	**128**
*OK2BRA	*	13,552	118	88
*OK1KZ	*	1,862	47	38
***OK2NN**	**21**	**212,625**	**407**	**315**
*OK1MMN	*	17,290	98	91
***OL7S**	**14**	**835,263**	**919**	**531**
			(Op: OK2BU)	
*OK1ZP	*	370,755	561	385
*OK1BA	*	173,800	356	275
*OK2BEM	*	106,690	262	235
*OK2BQL	*	4,218	40	37
***OK6A**	**7**	**849,807**	**813**	**423**
			(Op: OK2CMW)	
***OK2BYW**	**7**	**781,704**	**662**	**423**
*OLØA	*	400,362	437	318
			(Op: OK1CZ)	
*OK2BYH	*	132,209	215	187
***OK2PXD**	**3.5**	**27,878**	**127**	**106**
***OL6T**	**1.8**	**139,360**	**338**	**208**

			(Op: OM4TQ)	
*OM3CDN	*	71,749	206	157

BELGIUM

***ON6NR**	**A**	**693,880**	**770**	**440**
			(Op: ON4RU)	
***ON5UM**	**A**	**193,500**	**380**	**250**
*ON5HY	*	150,682	355	229
*ON5WL	*	69,906	233	183
*ON4KVA	*	19,536	96	88
*ON/G3VQO/P	*	13,320	102	90
***ON6CW**	**21**	**55,680**	**293**	**128**

FAROE IS.

OY1CT	**A**	**2,249,496**	**2478**	**628**

DENMARK

***OZ8AE**	**A**	**1,273,912**	**1155**	**551**
***OZØF**	**A**	**481,280**	**724**	**376**
*OZ1BMA	*	234,610	466	290
*OZ4FF	*	104,640	238	192
*OZ4RT	*	58,968	189	162

THE NETHERLANDS

PA4A	**A**	**612,990**	**837**	**417**
PA5A	**A**	**510,368**	**726**	**389**
PC4M	**A**	**480,060**	**684**	**378**
***PG7V**	**A**	**1,258,220**	**1452**	**530**
***PA1V**	**A**	**1,122,498**	**1157**	**507**
***PA3BFH**	**A**	**684,754**	**895**	**413**
*PCØH	*	299,222	475	319
*PA3HGF	*	104,867	305	211
*PAØSIM	*	10,842	87	78
*PA4M	*	5,586	60	57
***PG4I**	**14**	**186,113**	**255**	**217**
*PA3ADJ	*	74,925	241	185
***PAØMIR**	**3.5**	**147,368**	**305**	**218**

SLOVENIA

S5Ø46A	**A**	**1,925,770**	**1404**	**610**
			(Op: S56A)	
S52EZ	**21**	**1,207,884**	**1158**	**573**
S51J	*	335,574	583	362
S57Z	**14**	**2,907,324**	**1818**	**747**
S5ØR	**14**	**2,831,760**	**1770**	**760**
S5Ø41U	*	190,377	415	297
			(Op: S51U)	
S57AW	**3.5**	**1,333,014**	**999**	**489**
S51OI	**7**	**2,540,412**	**1305**	**593**
S57M	**1.8**	**254,597**	**442**	**259**
***S52OP**	**A**	**1,848,000**	**1481**	**600**
***S58WW**	**A**	**1,493,972**	**1235**	**556**
*S51NM	*	110,584	240	184
*S58RU	*	105,000	293	210
***S57J**	**21**	**420,945**	**617**	**399**
*S51NZ	*	281,750	491	350
***S54A**	**7**	**1,278,654**	**905**	**507**
***S5Ø47L**	**3.5**	**511,825**	**663**	**347**
			(Op: S57L)	
***S53F**	**7**	**1,490,778**	**1007**	**513**

SWEDEN

8S6E	**A**	**1,870,239**	**1624**	**609**
			(Op: SM6FUD)	
7S6A	**A**	**385,112**	**537**	**364**
			(Op: SM6JSM)	
SM2T	**7**	**957,708**	**804**	**444**
			(Op: SM2EZT)	
***7S7V**	**A**	**1,721,278**	**1409**	**554**
***SC2AG**	**A**	**1,134,768**	**1514**	**503**
			(Op: SM2DMU)	
***8SØF**	**A**	**842,595**	**1252**	**447**
			(Op: SMØOGQ)	
*SJ9WL	*	410,058	687	342
			(Op: DL3KWR)	
*SM7BJW	*	290,500	452	332
*SM2YIZ	*	224,388	482	271
*SM6XKB	*	95,348	274	197
*SMØBDS	*	66,736	195	194
*SM5QU	*	63,883	227	193
*SM6DUA	*	11,658	104	87
***SM6N**	**28**	**13,020**	**124**	**93**
			(Op: SM6NJK)	
***SM3AVW**	**21**	**84,048**	**318**	**204**
*SM4F	*	50,050	252	175
			(Op: SM4DHF)	
*SM5DYC	*	14,880	120	93
*SM7BQX	*	11,484	96	87
***SM6X**	**14**	**633,139**	**797**	**431**
			(Op: SM6CLU)	
***SM3X**	**14**	**600,208**	**798**	**466**
			(Op: SM3CVM)	

POLAND

SN2N	**A**	**1,139,040**	**1190**	**504**
			(Op: SP2ASJ)	
SP4BEU	**A**	**681,300**	**816**	**450**
SP2QG	*	341,946	634	363
SP2GKQ	*	4,485	116	39
SP9W	**28**	**76,973**	**343**	**191**
SP4AVG	**21**	**74,704**	**244**	**203**
SN5N	**14**	**1,081,976**	**1090**	**556**
SN7Q	**7**	**4,013,658**	**1713**	**699**
SP4Z	**7**	**2,110,710**	**1138**	**570**
SQ4MP	**3.5**	**696,150**	**781**	**390**
SP4DEU	**3.5**	**657,944**	**737**	**379**
***SP4ZO**	**A**	**1,845,823**	**1563**	**577**
***SP9KRT**	**A**	**1,141,760**	**1066**	**512**
			(Op: SP9ADU)	
***SP4JCQ**	**A**	**1,134,828**	**1139**	**522**
*SP3BJK	*	886,410	1067	469
*SN5J	*	757,588	773	442
			(Op: SP5JXK)	
*SQ9FMU	*	670,740	789	420
*SP9FT	*	489,555	689	387
*SP9GFI	*	488,178	669	333
*SQ9IDE	*	467,777	708	359
*SQ9MZ	*	443,394	664	378
*3Z8Z	*	417,960	584	387
*SP1NY	*	398,310	566	355
*SP2DNI	*	299,400	574	300
*SP2HPD	*	287,622	529	342
*SP8FHJ	*	250,230	493	285
*SP9CV	*	233,778	442	282
*SP5CGN	*	173,536	368	272
*SO1RON	*	161,622	366	246
*SP6CES	*	136,284	346	246
*SP3DIK	*	133,518	324	231
*SP3CUG	*	132,696	367	228
*SP7FBQ	*	111,720	302	228
*SP4CQU	*	86,866	212	169
*LZ3SM	7	343,252	452	299

AUSTRIA

OE5CWL/6	**A**	**2,733,970**	**1905**	**655**
OE2G	**A**	**2,103,940**	**1469**	**590**
OE1TKW	*	20,210	104	94

FINLAND

OH9A	**A**	**4,054,544**	**2660**	**772**
			(Op: K5AW)	
OH5NE	**A**	**754,720**	**996**	**424**
OH6DH	**A**	**684,335**	**892**	**415**
OH2CI	*	373,946	583	362
OH2VZ	*	241,344	447	288
OH5BM	*	213,696	492	288
OH1BOI	*	81,328	216	184
OH1MM	*	31,242	222	127
OH4A	**14**	**3,196,791**	**2005**	**801**
			(Op: OH6QU)	
OH2PM	**7**	**1,511,936**	**1012**	**512**
OH6XX	**3.5**	**536,670**	**686**	**335**
OH9W	**1.8**	**68,376**	**218**	**148**
			(Op: OH2BCI)	
***OH4R**	**A**	**1,999,404**	**1769**	**612**
			(Op: OH4YR)	
***OH3WW**	**A**	**568,028**	**765**	**413**
***OH6GAW**	**A**	**265,914**	**512**	**306**
*OH5UFO	*	129,800	340	220
*OH2KM	*	111,471	337	219
OL4M	*	497,945	637	347
***OL6P**	**A**	**1,946,510**	**1566**	**610**
			(Op: OK2WTM)	
***OK2DU**	**A**	**1,682,737**	**1498**	**571**
***OK1HX**	**A**	**1,590,435**	**1360**	**561**
*OK1VD	*	1,473,024	1234	548
*OK2ZC	*	1,427,846	1343	553
*OK2AB	*	982,557	1045	453
*OK1VBA	*	652,680	734	420
*OK1DKO	*	582,120	690	385
*OK2PHC	*	487,696	688	374
*OK1TC	*	455,112	603	378
*OK2SGY	*	442,260	535	364
*OK1DXD	*	416,059	547	343
*OK2BDF	*	359,046	490	327
*OK1DKR	*	339,528	480	329
*OK1IBP	*	331,785	526	303
*OK2SJ	*	330,820	493	340
*OK2TCW	*	309,510	590	342
*OL6W	*	306,612	534	334
			(Op: OK2FB)	
*OK1MZO	*	244,229	417	283
*OK2BNC	*	243,528	454	292
*OK2TBC	*	191,526	403	274
*OK1AY	*	167,520	358	240
*OK1WWJ	*	126,280	293	220
*OK1ARO	*	117,363	292	213
*OK2GG	*	116,946	282	219
*OK1DXK	*	18,270	108	87
			(Op: OK1DCF)	

SLOVAKIA

OM3OM	**A**	**1,408,812**	**1298**	**501**
OM7JG	**21**	**1,230,760**	**1172**	**580**
OM2VL	**14**	**3,480,570**	**2015**	**810**
OM7PY	**7**	**312,816**	**405**	**294**
OM3ZWA	**3.5**	**541,692**	**603**	**367**
***OM4DN**	**A**	**975,568**	**1056**	**482**
***OM8ON**	**A**	**769,405**	**830**	**445**
***OM5JA**	**A**	**719,982**	**973**	**402**
*OM1AF	*	480,807	716	369
*OM3BA	*	423,984	641	363
*OM7TJ	*	407,740	535	370
			(Op: OM7TJ)	
*OM3PQ	*	311,052	539	322
*OM8AQ	*	306,234	524	321
*OM4DA	*	187,952	408	272
*OM1AW	*	165,908	312	236
*OM4JD	*	54,020	165	146
*OM7AG	*	43,878	180	142
***OM7CA**	**14**	**683,587**	**779**	**509**
*OM3CFR	*	42,194	169	146
***OM4WW**	**7**	**562,650**	**576**	**363**
*OM2AK	*	120,139	267	191
***OM3ROM**	**3.5**	**143,405**	**305**	**215**

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ICOM

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*SP2MKI	*	84,219	251	201
*SQ9DXN	*	83,420	202	172
*SP2UKB	*	67,025	205	175
*SP9OYK	*	59,850	200	171
*SP3XR	*	36,449	162	127
*SP7BDS	*	27,494	144	118
*SP9ADV	*	25,764	132	114
*SP9IHP	*	21,630	97	70
*SP2DKI	*	15,834	109	91
*SP1DTG	*	7,672	57	56
*SP3JIA	*	5,432	61	56
*SP6BSL	*	108	6	6
***SP3LWP**	**28**	**35,321**	**237**	**143**
*SP5GH	*	3,564	54	54
***SP5ELA**	**21**	**47,895**	**173**	**155**
*SP7FGA	*	30,024	160	108
*SP2AYC	*	24,476	131	116
***SP9DLY**	**14**	**258,060**	**439**	**340**
***SP9GKM**	**14**	**204,222**	**404**	**303**
*SP2DWA	*	3,870	46	45
*SP4AAZ	*	2,904	34	33
***SP5KEH**	**7**	**1,067,724**	**884**	**446**
			(Op: SP5JTF)	
*SP3FYX	*	523,418	582	343
*SP9EMI	*	321,771	350	283
*SP4DZT	*	11,250	47	45
***SP9XCN**	**3.5**	**478,485**	**628**	**343**
*SQ9UM	*	187,308	352	242
*SP9DUX	*	125,636	293	196
*SQ9AOJ	*	1,512	33	27

GREECE

***J47HW**	**A**	**655,234**	**903**	**401**
*SV2AEL	*	10,160	95	80
***J43J**	**14**	**1,211,860**	**1362**	**590**
			(Op: DJ5JH)	
***SV1ENG**	**14**	**1,012,044**	**1134**	**561**
*SX2B	*	372,666	606	399

CRETE

***J49PM**	**A**	**1,439,124**	**1531**	**516**
			(Op: HB9IQB)	

BOSNIA & HERZEGOVINA

T98U	**A**	**1,082,943**	**1082**	**513**
T94NO	**14**	**1,885,680**	**1630**	**648**
T94DO	**7**	**620,312**	**655**	**371**
T99Z	**1.8**	**142,596**	**319**	**204**
***T94FC**	**14**	**1,220,802**	**1130**	**583**
***T9/9A5AX**	**7**	**1,861,398**	**1171**	**553**
			(Op: T99W)	

ICELAND

***TF3GB**	**A**	**230,584**	**431**	**296**

EUROPEAN RUSSIA

RK4FF	**A**	**4,213,880**	**2688**	**785**
RZ3AZ	**A**	**3,389,664**	**2280**	**744**
RW3GU	**A**	**2,117,646**	**1779**	**639**
UA4WA	*	2,044,760	1951	620
RN4WA	*	1,994,761	1943	617
RT3T	*	1,876,844	1720	607
			(Op: UA3TU)	
RU4WW	*	1,669,096	1541	572
RK3BA	*	852,280	1042	440
UA3UJE	*	698,862	828	433
UA3TCJ	*	612,264	701	388
RX3AEX	*	427,686	677	357
UA6AF	*	326,007	608	333
RZ3DA	*	289,674	479	342
RX3OM	*	229,425	450	285
RA3TT	*	219,047	503	317
RA3FD	*	174,500	405	250
RX3ZX	*	102,424	320	217
UA6JFG	*	68,970	245	165
RV1CC	*	21,054	101	87
UA1AKE	*	17,182	99	71
RU3DX	*	1,280	16	16
RZ3AV	**21**	**179,180**	**378**	**289**
RA3XO	*	148,289	329	257
RW4LE	*	49,536	194	172
RT3A	**14**	**2,008,876**	**1661**	**692**
RU4HP	**14**	**1,833,958**	**1450**	**707**
RF4R	**14**	**1,250,718**	**1103**	**614**
			(Op: UA4RC)	
RA3XM	*	1,023,700	1055	580
RN6CF	*	778,824	896	522
RW6FO	*	620,310	902	465
UA3UAT	*	542,328	671	472
RA6DB	*	406,072	642	386
RN6AL	**7**	**896,328**	**768**	**422**
RU4CO	**7**	**600,412**	**629**	**367**
UA4HOX	*	441,017	519	313
UA6AKD	*	321,488	422	284
***UA4FER**	**A**	**2,781,432**	**2016**	**711**
***RW3GB**	**A**	**2,252,775**	**1767**	**613**
***RU6FA**	**A**	**1,607,311**	**1575**	**541**
*UA3ABJ	*	1,554,225	1346	575
*RA3NZ	*	1,372,515	1372	555
*UA4WLI	*	940,940	1175	455
*RD4WA	*	828,675	973	435
*UA3PW	*	792,120	1000	460
*UA1ZZ	*	624,655	877	461
			(Op: UA1ZZ)	
*UA4ALI	*	576,638	745	401
*RV1AT	*	519,616	837	368
*RV3QX	*	499,865	675	389
*UA4AGO	*	408,972	648	346
*RV3LO	*	382,796	542	332
*RA6MS	*	332,367	541	323
*RA1QJA	*	323,642	544	313
*RN3BD	*	319,255	635	335
*RZ6HF	*	311,880	535	345
*UA6HON	*	306,160	488	320
*RK6MY	*	303,841	490	293
*RW3AFY	*	225,201	470	271
*RA1QJJ	*	223,340	484	260
*UA4HJ	*	211,558	411	278
*UA3AKI	*	175,784	414	292
*RU3XB	*	172,368	359	252
*RA3UAG	*	164,656	363	251
*RU3WR	*	151,466	384	217
*RW4HM	*	143,565	363	255
*RZ6LW	*	123,221	256	203
*RX3AGQ	*	110,376	299	216
*RW4AD	*	100,167	292	193
*UA6JY	*	78,210	208	165
*RX3MM	*	71,449	208	173
*RX3DBG	*	66,612	257	182
*RA4FJV	*	63,269	235	151
*RD3AN	*	62,920	178	143
*RK3DSW	*	53,874	166	146
*UA3LEL	*	26,505	103	95
*RN6FK	*	25,721	105	89
*RV6ASU	*	13,916	79	71
*RA6YDX	*	12,144	95	92
*RD3FT	*	12,070	100	85
*RA4SD	*	8,928	68	62
*RD3AO	*	8,160	62	60
*RU3VD	*	5,145	51	49
*RA1AFT	*	3,588	48	46
*UA4PT	*	3,366	37	34
*RW3SU	*	3,276	32	28
*RZ3OV	*	3,003	34	33
*UA6ART	*	782	24	23
*UA3XGM	*	390	16	15
*RA1QX	*	162	9	9
***UA3QG**	**28**	**6,528**	**80**	**68**
***RN1TN**	**21**	**357,019**	**615**	**377**
*RA3AN	*	329,604	576	363
*RU4SS	*	260,946	493	342
*RW4LQ	*	5,640	50	47
***RU3HD**	**14**	**1,422,420**	**1387**	**628**
***RA6LW**	**14**	**983,840**	**1062**	**572**
*UA4PCO	*	382,641	637	399
*UA4AN	*	235,840	443	320
*RA1OK	*	207,284	491	308
*RW6AH	*	149,640	362	258
*RK6CM	*	144,560	358	278
*UA4AAC	*	117,744	290	223
*UA6AK	*	110,250	450	175
*UA3RAW	*	69,723	221	183
*UA3VFI	*	16,060	118	110
*UA1ANX	*	14,852	112	94
*UA4PAY	*	14,550	104	97
*RN3AQ	*	10,764	80	78
*RN1AO	*	9,225	95	75
*UA4ACP	*	9,125	79	73
***RK4HD**	**7**	**419,184**	**473**	**328**
*RV3VF	*	39,772	326	122
*RX6LDK	*	1,950	26	26
***UA3DTT**	**3.5**	**1,638**	**27**	**26**
***RN3CT**	**1.8**	**5,828**	**58**	**47**

KALINGRAD

***UA2FT**	**A**	**293,880**	**531**	**310**

UKRAINE

UYØIX	**A**	**1,623,008**	**1436**	**536**
UT2UB	**A**	**684,376**	**813**	**404**
UT4XU	**A**	**665,010**	**741**	**405**
UR7EU	*	199,688	368	229
UT3EK	*	5,481	67	63
UT5UGQ	*	3,360	46	42
UUØA	**28**	**389,064**	**838**	**377**
			(Op: UUØJX)	
UW5Q	**14**	**2,844,864**	**1954**	**792**
UT7QF	**14**	**1,887,844**	**1414**	**706**
UT2FA	**14**	**1,516,808**	**1386**	**646**
UT5UIA	*	770,804	857	524
UT5KO	*	474,255	685	405
UX4UA	*	371,711	557	337
US7IB	*	85,056	265	192
US1ITU	**7**	**2,762,448**	**1362**	**624**
UT4EK	*	599,472	576	368
UX5I	**3.5**	**521,721**	**663**	**339**
			(Op: UT5IZ)	
UY6IM	**3.5**	**491,576**	**598**	**344**
UYØZG	*	346,632	474	303
UR7QC	*	340,561	481	299
UX6F	**1.8**	**24,192**	**117**	**96**
			(Op: UR5FLA)	
***EM3H**	**A**	**2,248,932**	**1809**	**653**
			(Op: UR3HC)	
***UW5U**	**A**	**1,825,200**	**1571**	**600**
			(Op: UY2UA)	
***UY8IF**	**A**	**1,085,225**	**1157**	**523**
*UR6QS	*	943,480	982	458
*US6IMA	*	779,394	907	462
*UR8RF	*	356,408	591	299
*UY5ZI	*	348,651	499	333
*UT1IR	*	274,660	491	310
*US1IV	*	211,792	376	248
*EMØU	*	209,820	401	260
			(Op: UT3UZ)	
*UX8ZA	*	179,340	374	245
*UU2JA	*	138,000	303	240
*UTØRM	*	134,106	280	206
*UT5UML	*	101,258	287	197
*UR3IQO	*	93,960	214	174
*UT8NT	*	80,750	236	190
*UR5IBM	*	3,468	38	34
*UU9JQ	*	1,500	30	30
*UR5WDQ	*	8	2	2
***US5WMS**	**28**	**6,210**	**48**	**45**
***URØMC**	**21**	**597,054**	**794**	**453**
***UT5PW**	**21**	**90,288**	**254**	**216**
*US2WU	*	63,921	169	143
*UW5RO	*	45,522	183	162
*UR3PGI	*	17,765	105	95
*UX1HW	*	7,320	62	60
***UR4ZWL/P**	**14**	**1,130,320**	**1210**	**568**
***UR6IJ**	**14**	**1,096,640**	**1056**	**596**
***UXØZX**	**14**	**984,312**	**1042**	**567**
*US7IGF	*	813,624	944	501
*UR5FAV	*	787,968	935	512
*UX7QD	*	339,955	655	385
*UT4NY	*	227,728	470	331
*UY3QW	*	218,064	522	308
*UT1PO	*	212,480	412	320
*UR3LM	*	197,340	382	299
*UT3FM	*	168,200	392	290
*UY3AW	*	114,684	299	228
*UY5YA	*	38,776	180	148
***UR7EQ**	**7**	**735,600**	**679**	**400**
***EO1I**	**7**	**669,710**	**664**	**386**
			(Op: UT1IA)	
*UW2F	*	612,128	594	376
*UT4NW	*	369,050	409	305
*USØHZ	*	236,670	394	245
***UR5IHQ**	**3.5**	**85,484**	**225**	**172**
***USØZZ**	**1.8**	**167,307**	**346**	**217**
***UX5NQ**	**1.8**	**138,204**	**336**	**198**
*UT1FA	*	121,600	300	190
*UT3NK	*	81,158	254	154

LATVIA

YL4U	**A**	**3,160,275**	**2247**	**725**
			(Op: YL2KO)	
YL2PJ	**A**	**1,041,249**	**1005**	**417**
YL8M	7	1,020,156	825	453
YL2RR	*	428,298	503	323
YL2PQ	**3.5**	**744,876**	**803**	**396**
YL9W	**3.5**	**741,596**	**771**	**397**
***YL5W**	**A**	**1,233,920**	**1468**	**512**
***YL3AD**	**A**	**1,067,660**	**1028**	**506**
***YL3FW**	**A**	**354,063**	**559**	**321**
*YL3GCU	*	231,378	439	294
*YL2EC	*	202,168	442	296
*YL2GLU	*	124,752	250	226
*YL7C	*	59,520	191	155
			(Op: YL2MD)	
*YL2RM	*	49,907	176	143
*YL2HK	*	44,968	196	154
*YL2IP	*	8,064	72	64
*YL2II	*	4,230	50	47
***YL3DX**	**7**	**619,887**	**643**	**381**
***YL2BJ**	**3.5**	**19,188**	**100**	**82**
*YL2PN	*	2,850	39	38

ROMANIA

YR2I	**3.5**	**997,488**	**913**	**432**
			(Op: YO2DFA)	
YR7M	**7**	**2,527,806**	**1360**	**601**
			(Op: YO3JOS)	
YO3FF/P	**28**	**102,600**	**340**	**225**
***YO3APJ**	**A**	**2,346,792**	**1733**	**687**
***YO5CBX**	**A**	**1,228,063**	**1181**	**493**
***YO5PBF**	**A**	**534,672**	**701**	**376**
*YO5CRQ	*	291,346	499	323
*YO5DAS	*	236,775	450	287
*YO3III	*	31,920	143	114
*YO3FLQ	*	17,538	122	111
***YO8MI**	**28**	**3,038**	**52**	**49**
***YO5BRZ**	**21**	**204,930**	**436**	**297**
*YO9AGI	*	86,528	269	208
***YO8BIG**	**14**	**505,728**	**776**	**439**
***YO4ATW**	**14**	**408,276**	**621**	**396**
*YO4B8H	*	270,660	500	347
*YO7RFH	*	214,286	416	307
*YO8RIX	*	32,535	157	135
*YO4CSL	*	15,070	191	55
***YR5A**	**7**	**1,295,800**	**1060**	**475**
			(Op: YO5OHO)	

SERBIA

YT6A	**A**	**6,892,628**	**3135**	**908**
YZ2ØØA	**A**	**1,304,625**	**1119**	**525**
			(Op: YZ1AA)	
YZ1AU	**21**	**1,592,784**	**1414**	**648**
YT1BB	**21**	**1,243,125**	**1245**	**585**
4N9Z	**14**	**3,498,096**	**2184**	**812**
YU1EA	**14**	**3,124,240**	**1961**	**784**
YT5A	*	2,576,060	1782	755
YT7A	*	2,439,696	1678	742
			(Op: YU7GMN)	
***YU1AU**	**A**	**1,821,777**	**1472**	**589**
***YU1WC**	**A**	**1,212,300**	**1080**	**540**
*YU1KT	*	906,231	1041	457
*YU8/OK1CRM	*	873,392	1010	442
*YU7AM	*	49,558	197	142
***YU1FG**	**28**	**41,976**	**198**	**159**
***YU1IG**	**21**	**271,200**	**480**	**339**
*YT7Z	*	205,190	438	289
			(Op: YU7EU)	
***YT1LT**	**14**	**1,054,401**	**1085**	**557**
*YU7KM	*	335,220	502	370
***YU7DP**	**7**	**220,745**	**333**	**245**
***4N6ØØA**	**3.5**	**600,008**	**671**	**358**
			(Op: YU1YV)	
***YU1RA**	**1.8**	**101,903**	**275**	**181**

MACEDONIA

Z36W	**A**	**120,060**	**380**	**230**
***Z37M**	**14**	**2,223,760**	**1692**	**722**
			(Op: Z32ID)	

MARITIME MOBILE

***SP1LJP/MM**	**14**	**698,782**	**864**	**497**

OCEANIA

EAST MALAYSIA

9M6A	**A**	**3,515,935**	**1771**	**563**
			(Op: ES2RR)	
***9M8DX**	**21**	**2,684,112**	**1612**	**562**
			(Op: VK6DXI)	

SAIPAN

WHØV	**7**	**148,338**	**205**	**123**

GUAM

***NH2DX**	**A**	**2,977,380**	**1577**	**556**
			(Op: KG6DX)	

HAWAII

KH6NF	**A**	**1,932,736**	**1249**	**404**
KH6ND	**7**	**2,995,778**	**1121**	**458**
***K2RD/KH6**	**A**	**7,216**	**52**	**44**

AUSTRALIA

VK3IO	**A**	**157,314**	**221**	**157**
VK1AA/4	**14**	**2,478,450**	**1362**	**615**
VK2IA	**7**	**1,314,450**	**596**	**381**
VK2CZ	3.5	8	2	2
***VK2KM**	**A**	**281,316**	**329**	**238**
***VK8AV**	**A**	**242,871**	**294**	**219**
***VK6AA/2**	**21**	**3,783**	**39**	**39**
***VK4BUI**	**14**	**249,150**	**312**	**275**
*VK4TT	*	94,952	196	166

INDONESIA

***YC2VY**	**A**	**36,064**	**109**	**98**
***YD3LGF**	**21**	**441,945**	**493**	**305**
*YB2DGR	*	154,518	291	182
***YB8HZ**	**14**	**11,741**	**67**	**59**

NEW ZEALAND

ZL1ALZ	**A**	**259,154**	**401**	**214**
ZM6CL	**7**	**602,490**	**395**	**266**
			(Op: ZL2AGY)	
***ZL4HH**	**A**	**1,062,228**	**724**	**381**
***ZL/W3SE**	**A**	**870,320**	**648**	**344**

SOUTH AMERICA

CHILE

XR2F	**A**	**587,520**	**544**	**306**
			(Op: K4UEE)	
CE3BFZ	**A**	**217,308**	**354**	**199**
***XQ4ZW**	**A**	**54,488**	**106**	**98**
***XQ2NJ**	**7**	**11,616**	**51**	**44**

URUGUAY

CX7BY	**14**	**1,410,696**	**947**	**504**

FRENCH GUIANA

FY5FY	**A**	**7,158,552**	**2607**	**787**

ARGENTINA

LPØH	**A**	**2,939,380**	**1459**	**590**
			(Op: LU7HN)	
LU7EE	**A**	**2,370,221**	**1312**	**571**
LU1MA	*	436,241	499	299
AYØF	**28**	**1,920,402**	**1186**	**549**
			(Op: LU2FM)	
LU5FC	**21**	**3,144,980**	**1594**	**670**
LT1F	**21**	**1,347,672**	**958**	**482**
			(Op: LU1AEE)	
*LU3FL	*	572,276	617	316
***LU5FF**	**14**	**1,845,657**	**1147**	**543**
*LU5YF	3.5	147	7	7

PERU

OC4WW	**A**	**10,996,334**	**3245**	**914**
			(Op: EA4BQ/OH0XX)	

ARUBA

P4ØL	**A**	**10,338,074**	**3283**	**901**
			(Op: W6LD)	
***P43E**	**A**	**1,213,375**	**881**	**425**

NETHERLANDS ANTILLES

PJ2W	**A**	**7,350,001**	**2685**	**799**
			(Op: WI9WI)	

BRAZIL

PV8DX	**A**	**2,153,295**	**1191**	**545**
PY7ZY	**A**	**1,280,532**	**798**	**436**
PY4RGS	*	322,750	330	250
PP5UA	*	133	7	7
PT5T	*	65	5	5
PS2E	**28**	**492,038**	**531**	**314**
			(Op: PY2EX)	
PT5A	**21**	**6,139,755**	**2429**	**855**
			(Op: PY2EMC)	
PX2A	**21**	**4,991,625**	**2203**	**765**
			(Op: PY2WB)	
PY2YP	*	520,605	519	345
PY2NY	**14**	**2,287,584**	**1268**	**611**
***PR7AB**	**A**	**2,034,922**	**1134**	**499**
***ZZ8Z**	**A**	**764,650**	**650**	**373**
			(Op: PY8AZT)	
***PY7EG**	**A**	**675,150**	**654**	**350**
*PY4FQ	*	473,445	497	315
*PY2NB	*	137,060	252	178
*PP7CW	*	124,620	202	155
*PY7OJ	*	31,944	111	88
*PT2BW	*	14,586	89	66
*PS7DX	*	2,940	31	30
*PY7AEF	*	1,932	23	21
*PU5AOS	*	40	4	4
*PR7FN	*	1,595	29	29
*PY2BRZ	*	504	14	12
***PY8DAN**	**21**	**349,272**	**420**	**294**
*PY4CEL	*	123,072	231	192
*PY2RH	*	94,402	211	154
***PY2PT**	**14**	**128,712**	**238**	**186**
***PR7AR**	**3.5**	**88,920**	**134**	**114**

NICARAGUA

***H6C**	**14**	**529,310**	**604**	**584**
			(Op: YN4SU)	

VENEZUELA

YV5OHW	**7**	**2,746,107**	**973**	**479**
***YV7QP**	**A**	**149,264**	**174**	**152**
***YY5YMA**	**21**	**220,500**	**350**	**225**
***YV5AAX**	**14**	**198,050**	**286**	**233**
***YY5AFD**	**7**	**49,880**	**103**	**86**

TRIBANDER/SINGLE ELEMENT

UNITED STATES

N2GC	**A**	**2,538,102**	**1429**	**623**
AK2P	*	2,430,000	1423	675
			(Op: W3MMM)	
K4BAI	**A**	**2,188,095**	**1507**	**637**
N6CW	**A**	**2,001,144**	**1385**	**597**
N3UM	**A**	**1,917,272**	**1232**	**584**
AD4EB	*	1,261,050	1084	525
N8PW	**A**	**1,040,638**	**857**	**482**
W4BQF	*	1,018,354	977	479
WA9IRV	**A**	**1,005,168**	**1061**	**487**
W6TK	*	938,442	898	458
WØZP	**A**	**574,062**	**905**	**397**
KA2MGE	*	532,508	567	382
K9UQN	*	524,188	621	386
W7QN	**A**	**350,892**	**614**	**324**
KO7X	*	300,793	588	313
W6NKR	*	288,260	420	290
W4NTI	*	257,439	396	273
N5PU	*	183,222	327	243
N4MM	*	135,136	239	206
WA6OGO	*	61,292	250	154
W7LKG	*	50,440	160	130
KW5DX	**14**	**604,467**	**725**	**423**
			(Op: K1NT)	
KØCAT	**14**	**457,581**	**583**	**381**
			(Op: K9WIE)	
K9CC	**7**	**377,872**	**537**	**304**
AB1U	**7**	**35,504**	**129**	**112**
			(Op: W6RKC)	
NT6K	**3.5**	**101,592**	**265**	**153**
***WA1S**	**A**	**1,381,990**	**1177**	**565**
***WB2AA**	**A**	**1,352,574**	**1024**	**489**
***N6HC**	**A**	**1,247,344**	**1185**	**518**
*WR1TE	*	652,589	670	371
			(Op: W1JQ)	
*WN6K	*	647,112	837	354
***WB8TLI**	**A**	**537,280**	**545**	**365**
*KNØWCW/2	*	518,408	603	344
			(Op: N2ED)	
***NA4K**	**A**	**478,254**	**597**	**354**
*K4DJ	*	404,240	460	326
*KH2D	*	401,250	521	321
***KEØUI**	**A**	**322,792**	**539**	**314**
*K1GU	*	281,124	404	274
***KI7Y**	**A**	**200,692**	**407**	**262**
***AC5AA**	**A**	**109,804**	**262**	**194**
*W8PN	*	97,704	248	177
*N7ZG	*	95,392	256	176
*WX4TM	*	69,472	199	167
*KØHW	*	64,295	209	167
*K2PS	*	64,200	200	150
*KK1W	*	34,336	133	116
*KE4OAR	*	27,976	124	104
*W4AU	*	19,845	89	81
*KYØW	*	7,686	77	61
			(Op: W6ZZZ)	
*K7TR	*	756	22	18
***WA1FCN**	**21**	**178,358**	**413**	**257**
***K8IA**	**14**	**1,006,560**	**950**	**540**
***K2TA**	**7**	**44,100**	**108**	**100**

DX

CT3KN	**A**	**5,864,082**	**2032**	**714**
TI3M	**A**	**4,791,456**	**2432**	**786**
			(Op: TI3TLS)	
RA9SG	**A**	**4,706,565**	**1992**	**645**
HG8R	**A**	**4,101,084**	**2355**	**762**
AN5FV	**A**	**3,913,785**	**2671**	**795**
IS0/S52A	**A**	**3,854,228**	**2354**	**769**
			(Op: S59AA)	
G3XTT	**A**	**3,462,030**	**2263**	**715**
9M2/G4ZFE	**A**	**3,403,260**	**2027**	**630**
RZ3AZ	**A**	**3,389,664**	**2280**	**744**
OL5Y	**A**	**2,830,750**	**1898**	**670**
OE5CWL/6	**A**	**2,733,970**	**1905**	**655**
HA3LI	*	2,625,456	1816	664
OLØW	*	2,530,440	1790	660
			(Op: OK1DSZ)	
UA9SP	*	2,342,736	1274	493
OY1CT	**A**	**2,249,496**	**2478**	**628**
RW3GU	*	2,117,646	1779	639
GØMTN	*	2,104,395	2072	587
DL5YM	**A**	**1,985,862**	**1516**	**606**
OK1EP	*	1,944,320	1611	620
KH6NF	**A**	**1,932,736**	**1249**	**404**
DF1LON	*	1,549,260	1311	570
OK2PDT	*	1,492,920	1390	572
PY7ZY	**A**	**1,280,532**	**798**	**436**
IK2UCK	*	1,277,430	1361	553
DL1NEO	*	1,185,052	1127	506
EW1CQ	**A**	**1,177,498**	**1081**	**557**
OH6DH	**A**	**684,335**	**892**	**415**
GM2Z	**A**	**654,432**	**1149**	**401**
			(Op: MMØDFV)	
OK2ABU	*	500,050	637	365
PC4M	**A**	**480,060**	**684**	**378**
SP2QG	**A**	**341,946**	**634**	**363**
JA1HP	**A**	**271,183**	**417**	**277**
JF9JTS	*	250,444	359	254
JA1QOW	*	243,552	358	236
OH2VZ	*	241,344	447	288
OH5BM	*	213,696	492	288
UN5J	**A**	**172,800**	**312**	**216**
EX8O	**A**	**115,839**	**273**	**183**
OH1BOI	*	81,328	216	184
JA3DAY	*	56,032	154	136
G4BJM	*	29,003	116	97
EA6AZ	**A**	**3,520**	**51**	**44**
DK2GZ	**21**	**735,505**	**881**	**509**
RA6DB	**14**	**406,072**	**642**	**386**
JA9CWJ	**14**	**42,408**	**126**	**124**
4U1VIC	**7**	**2,411,288**	**1474**	**583**
			(Op: JH4RHF)	
RU4CO	**7**	**600,412**	**629**	**367**
YL2RR	**7**	**428,298**	**503**	**323**
OK1RR	**3.5**	**710,328**	**692**	**408**
EU1AZ	**3.5**	**674,304**	**761**	**384**
***9H3MM**	**A**	**4,647,705**	**3192**	**809**
			(Op: DF4SA)	
***NH2DX**	**A**	**2,977,380**	**1577**	**556**
			(Op: KG6DX)	
***YO3APJ**	**A**	**2,346,792**	**1733**	**687**
***DL2OBF**	**A**	**2,153,088**	**1732**	**623**
***PR7AB**	**A**	**2,034,922**	**1134**	**499**
***LZØ4KM**	**A**	**1,971,162**	**1700**	**633**
			(Op: LZ3YY)	
***YU1AU**	**A**	**1,821,777**	**1472**	**589**
***7S7V**	**A**	**1,721,278**	**1409**	**554**
*DL7BY	*	1,608,922	1292	574
***OK1HX**	**A**	**1,590,435**	**1360**	**561**
***S58WW**	**A**	**1,493,972**	**1235**	**556**
***OK2ZC**	**A**	**1,427,846**	**1343**	**553**
***OHØEC**	**A**	**1,389,484**	**1474**	**563**
			(Op: DL1EKC)	
***OZ8AE**	**A**	**1,273,912**	**1155**	**551**
*YU1WC	*	1,212,300	1080	540
***JH2NWP**	**A**	**1,144,731**	**829**	**453**
***PA1V**	**A**	**1,122,498**	**1157**	**507**
***YL3AD**	**A**	**1,067,660**	**1028**	**506**
***HSØZDZ**	**A**	**1,048,581**	**929**	**443**
***VE3KP**	**A**	**974,044**	**758**	**404**
***UA4WLI**	**A**	**940,940**	**1175**	**455**
*SP3BJK	*	886,410	1067	469
***EU2MM**	**A**	**882,519**	**985**	**517**
***9V1GO**	**A**	**810,020**	**803**	**404**
*SN5J	*	757,588	773	442
			(Op: SP5JXK)	
*JA2KVB	*	713,592	679	408
***ON6NR**	**A**	**693,880**	**770**	**440**
			(Op: ON4RU)	
*OK1VBA	*	652,680	734	420
***5B4/OL8R**	**A**	**628,187**	**539**	**301**
			**

*SP7FBQ	*	111,720	302	228
***OH2KM**	**A**	**111,471**	**337**	**219**
*JA2VZL	*	103,180	224	154
*OK2QX	*	101,689	274	199
*VA3UA	*	93,987	218	177
*JJ6TWQ	*	93,002	200	146
*SP2MKI	*	84,219	251	201
*DL5NDX	*	72,962	225	191
***MJØASP**	**A**	**68,056**	**206**	**188**
*JA2PFO	*	55,775	158	115
***LZ5PL**	**A**	**49,284**	**194**	**148**
*7J1AIL	*	42,840	147	126
*JAØXZD	*	26,226	107	94
*SP9ADV	*	25,764	132	114
*LZ4BU	*	19,980	99	90
*DL1EFD	*	19,596	99	92
*YO3FLQ	*	17,538	122	111
*ON/G3VQQ/P	*	13,320	102	90
*JH1WFK	*	12,709	79	71
***HB9CZF**	**A**	**9,301**	**75**	**71**
***K2RD/KH6**	**A**	**7,216**	**52**	**44**
***YU1FG**	**28**	**41,976**	**198**	**159**
***S51NZ**	**21**	**281,750**	**491**	**350**
***JA1BPA**	**21**	**88,784**	**198**	**179**
***SM4F**	**21**	**50,050**	**252**	**175**
			(Op: SM4DHF)	
***J43J**	**14**	**1,211,860**	**1362**	**590**
			(Op: DJ5JH)	
*G3ZRJ	14	554,931	719	459
*VO1TA	14	199,360	311	224
*VK4TT	14	94,952	196	166
*S54A	7	1,278,654	905	507
*ZT6T	7	1,051,650	484	369
			(Op: ZS6MG)	
*UW2F	7	612,128	594	376
*IG9/IV3TMV	7	125	5	5
*PAØMIR	3.5	147,368	305	218
*OK2PXD	3.5	27,878	127	106
*ZS6MG	3.5	1,683	18	17
*RN3CT	1.8	5,828	58	47

ROOKIE

W6SJ	A	154,985	376	223
KR4M	A	130,562	259	194
CS6T	7	1,778,007	1022	537
			(Op: CT1ILT)	
UX6F	1.8	24,192	117	96
			(Op: UR5FLA)	
*US6IMA	A	779,394	907	462
*YL3GCU	A	231,378	439	294
*EI7JK	A	135,595	346	235
*JA1HTG	A	82,104	208	132
*KY2T	A	50,337	168	141
*VA3HUN	A	49,742	146	119
*N7EIE	A	32,643	188	117
*AE6NY	A	23,520	116	98
*VA7IRL	A	6,396	53	41
*YY5YMA	21	220,500	350	225
*UW5RO	21	45,522	183	162
*YT1LT	14	1,054,401	1085	557
*KI4EGT	14	101,504	259	208
*IZ3ESV	14	32,718	147	114
*UA1ANX	14	14,852	112	94
*YY5AFD	7	49,880	103	86

SINGLE OPERATOR ASSISTED

UNITED STATES

K3WW	A	5,997,446	2399	806
KI1G	A	5,076,994	2236	806
W1US	*	3,124,319	1542	659
			(Op: K1LZ)	
N8BJQ	A	2,065,621	1248	607
AB2E	A	1,912,840	1167	580
WF2B	*	1,420,767	1002	521
			(Op: K2ONP)	
W8FJ	*	1,193,920	845	448
K3KO	A	1,181,160	739	510
AJ1I	*	953,414	828	451
			(Op: W1EBI)	
W2YC	*	707,644	631	398
KØAD	A	388,476	695	327
N5JR	A	272,847	395	309
W3HVQ	*	243,076	388	268
KE1J	*	207,613	295	223
			(Op: K1IR)	
KC1F	*	167,993	301	233
KI6T	A	126,144	321	219
N6MZ	A	108,256	232	199
K5HDU	*	94,965	227	195
N2BJ	A	91,360	196	160
N6VH	*	74,100	255	156
KD2HE	*	59,296	164	136
WØTT	*	55,050	216	150
NF1A	*	6,200	56	50
AA4VV	7	240,840	245	216
*W1TO	A	351,780	434	286
*WØVX	A	348,320	512	311
*W2JU	*	181,566	337	231
*ND2T	A	151,632	320	234
*W1MD	A	106,766	211	211
*KB3MM	A	101,868	188	156
*K9OSH	A	100,902	247	201
*N7JB	A	79,388	271	178
*KW4CW	28	23,326	154	109
			(Op: N4GM)	
*NT5TU	14	9,727	74	71

DX

RG9A	A	7,353,010	2551	835
			(Op: UA9AM)	
JY9QJ	A	7,295,508	2715	801
S57DX	A	5,037,864	2657	804
LY4XX	A	4,266,448	2381	776
RD3A	A	4,161,520	2491	880
			(Op: RD3AF)	
UW8M	A	3,760,304	2426	796
			(Op: UR5MID)	
YT9X	A	3,319,344	2266	712
			(Op: YU1ZZ)	
RZ9HG	*	3,196,024	1547	632
YL6W	A	3,169,824	2287	742
			(Op: YL2GD)	
RN3QO	*	3,058,809	2066	733
HB9DDO	A	3,025,902	1947	722
SN8F	A	2,956,347	1909	723
			(Op: SP8FHK)	
UA3AGW	*	2,762,872	1818	721
DK3GI	A	2,621,692	1647	652
DJ2QV	*	2,610,788	1759	706
7S6N	A	2,534,220	1863	741
			(Op: SM6CNN)	
OK1FDY	**A**	**2,223,644**	**1575**	**631**
YLØA	*	2,219,634	1694	634
			(Op: YL2KA)	
OH6NIO	**A**	**1,861,020**	**1722**	**630**
F6IRF	**A**	**1,855,508**	**1289**	**614**
DL2RMC	*	1,578,933	1438	579
EA4KA	**A**	**1,319,576**	**1245**	**587**
HB9FBS	*	1,269,532	1194	484
OE8CIQ	**A**	**1,244,133**	**1135**	**531**
IK2AHB	*	1,161,000	1151	516
UY5ZZ	*	1,080,720	1012	570
IN3QBR	**A**	**992,936**	**1076**	**476**
7M4CDX	**A**	**908,150**	**781**	**410**
YU9VK	*	778,782	861	474
JS3CTQ	*	631,449	588	351
OM7YC	**A**	**440,895**	**625**	**357**
SM5D	*	375,360	623	340
LZ5ZI	**A**	**296,868**	**445**	**346**
VA6XDX	**A**	**203,155**	**328**	**205**
LY3BH	*	82,450	196	170
DF3CB	*	25,568	117	94
ES5QX	**21**	**1,024,336**	**1148**	**584**
OH6NJ	**21**	**559,676**	**888**	**458**
LS7D	**21**	**36,630**	**125**	**110**
			(Op: LU7DW)	
UZ8M	**14**	**2,295,218**	**1607**	**734**
			(Op: US0MR)	
OH8L	**14**	**1,607,680**	**1376**	**628**
			(Op: OH8LQ)	
EW2AA	**14**	**1,497,144**	**1234**	**642**
LY2IC	**7**	**898,875**	**781**	**425**
DL1HCM	**7**	**693,634**	**677**	**391**
SP8BRQ	**3.5**	**678,024**	**648**	**387**
EA5FID	**3.5**	**468,832**	**495**	**322**
JG1OWV	**3.5**	**936**	**14**	**13**
***ON5ZO**	**A**	**1,238,027**	**1204**	**497**
***JI1RXQ**	**A**	**1,145,536**	**903**	**448**
***SP3ASN**	**A**	**932,160**	**993**	**480**
***SV5DKL**	**A**	**755,580**	**1008**	**420**
***OK1AOV**	**A**	**730,800**	**688**	**435**
***UA9AX**	**A**	**654,408**	**574**	**366**
***DL4NER**	**A**	**595,408**	**630**	**398**
*OK2ZJ	*	442,260	633	364
***RXØLYP**	**A**	**384,250**	**656**	**265**
***PAØKHS**	**A**	**236,964**	**457**	**294**
*DL8NFU	*	223,287	399	283
***HA5PT**	**A**	**194,454**	**411**	**277**
*JA3PYC	*	181,101	299	201
***8SØW**	**A**	**154,258**	**321**	**221**
			(Op: SMØNJO)	
*JA1XUY	*	151,064	280	184
*JA4BAA	*	125,788	242	164
			(Op: JA4BAA)	
***S53AU**	**A**	**117,924**	**268**	**186**
*OK1UU	*	113,905	291	209
*DL6KVA	*	69,434	203	149
*IR2V	*	63,081	197	163
			(Op: I2WIJ)	
***ON7SS**	**A**	**48,334**	**153**	**143**
*JA1XRH	*	45,738	124	99
*DJ9MH	*	36,380	116	107
*RAØAM	*	27,976	105	104
*DJ1AA	*	24,402	118	98
*RU3AT	*	23,904	104	96
*DJ3DQ	*	23,836	118	101
*DL1CWI	*	22,077	115	99
*DK2ZO	*	19,024	93	82
*OK1CJN	*	12,950	79	70
***EI9ES**	**A**	**11,928**	**96**	**84**
***F5PHW**	**A**	**8,140**	**86**	**74**
*8S6T	*	6,545	60	55
			(Op: SM6WET)	
*JEØIUR	*	3,600	36	36
*JJ1BDX/3	*	3,224	32	31
*JK2VOC	*	2,128	34	28
*S59V	*	420	14	14
***YZ1V**	**7**	**1,516,200**	**1063**	**525**
			(Op: 4N1FAN)	
***Z32AF**	**3.5**	**517,218**	**616**	**349**
*4N2ØØA	1.8	578	19	17
			(Op: YU1UA)	

MULTI-OPERATOR SINGLE TRANSMITTER

UNITED STATES

NO2R	6,969,490	2637	935
NO5W	5,363,875	2592	913
W4ML	4,216,734	1997	739
NZ1U	4,106,418	2003	762
KX7M	3,713,825	2007	745
NØNI	2,829,631	1725	739
WX6V	2,689,044	1643	662
KE5C	787,203	948	423
NN6X	401,005	630	317
NB3O	186,588	275	219
N2BZP	3,060	40	36

NORTH AMERICA

VQ5V	12,951,027	4075	1007
VA7OO	5,858,048	2257	784
WP2Z	4,767,834	2138	762
VE3SMA	1,431,925	912	451
VE6AO	770,517	805	387
VE7FO	566,776	604	349

ASIA

RT9W	10,997,918	3396	886
UA9AYA	10,449,544	3284	874
RW9C	8,698,560	2903	820
RZ9OZO	7,236,131	2688	779
EX9A	5,122,876	2462	692
RM9W	1,960,840	1109	470
RK9JWV	1,835,918	1066	497
RZ8VWA	632,520	673	360
RKØUWC	480,889	609	317
JA8RWU	316,120	447	280

EUROPE

ED6IB	10,640,619	4647	1089
OM7M	8,985,150	3661	1025
T93M	8,014,938	3825	998
RL3A	8,011,990	3886	985
HG1S	7,772,000	3263	1000
HG6N	7,325,826	3258	958
OL8M	6,941,488	3142	929
GX6PZ	6,668,151	3666	933
YP3A	6,211,139	3394	913
OH1F	5,780,510	3248	919
YU1ARC	**5,515,653**	**2871**	**897**
OL7R	5,414,248	2568	872
UT1U	**5,079,118**	**2730**	**838**
RF3A	4,656,988	2923	826
S52ZW	**4,643,730**	**2542**	**819**
OH3MMM	4,270,442	2897	778
DLØOV	**4,105,992**	**2301**	**824**
SC3AG	**3,979,400**	**2577**	**808**
EA2URD	**3,758,688**	**2373**	**744**
RZ1QZZ	3,556,538	2465	766
OM3RKA	3,524,151	2064	731
OL3Z	3,465,339	2311	723
ES9A	**3,359,460**	**2543**	**730**
YZ7A	3,331,020	2275	735
SN5Z	**3,174,948**	**1992**	**774**
ED2JJ	3,164,625	2277	725
DC8QT	3,146,898	2094	699
OM4A	3,146,328	1977	712
UTØAZA	3,114,969	2489	689
UT7L	3,047,841	2105	719
PI4DEC	**2,741,361**	**2060**	**651**
S5/OL3W	2,659,602	1940	649
HG8N	2,549,817	1940	657
SI9AM	2,490,339	2402	643
YU7QL	2,390,168	1811	628
OK1KMU	2,284,375	1774	625
DL4WA	2,283,182	1691	649
TM5B	**2,199,736**	**1898**	**616**
OL2U	1,216,848	1225	502
PI4TUE	1,062,516	1152	546
OK1KDO	995,192	1098	473
YL1S	**744,292**	**905**	**428**
OM4K	650,256	768	437
HG1R	564,324	598	372
RZ1CXS	533,250	749	395
OK1KQH	512,413	697	407
OM3KHE	511,478	721	347
DLØYY	362,615	506	347
USØQ	244,149	469	291
G5X	242,985	625	291
UT4IYZ	162,225	352	225
R2MWO	130,075	295	215
UV7M	117,055	350	205
UT5IZO	79,380	277	189
HA5HRK	1,786	39	38
UT4UXW	165	13	11
LY1XM	84	6	6

OCEANIA

ZM1A	6,161,262	2094	706

SOUTH AMERICA

P4ØO	19,456,480	5135	1108
PS2T	14,473,564	3987	1022
LT5F	6,147,868	2359	779
PY3ARD	74,520	174	138

MULTI-OPERATOR TWO-TRANSMITTER

UNITED STATES

KM4M	16,283,745	4783	1095
WE4OJ	8,248,032	3374	936
WR3Z	5,790,164	2561	853
NM7D	3,839,040	2363	744
WX5S	3,788,934	2157	746

DX

PJ4U	17,502,264	4589	1084
RU1A	12,502,208	5618	1088
UU7J	10,553,056	5067	1021
VE7SV	7,663,365	2856	855
ZX3S	7,506,176	2741	872
DAØBCC	7,061,873	3646	923
LY4A	6,923,875	3656	965
SO6Y	5,486,684	3367	812
OJØSM	4,873,968	3773	748
OL7D	4,340,292	2744	786
UT8LL	3,583,118	2392	742
4D2X	1,024,797	933	339
OL9S	587,466	748	387

MULTI-OPERATOR MULTI-TRANSMITTER

UNITED STATES

NY4A	14,703,940	4518	1070
NN5J	7,535,628	3292	958
NG3U	1,742,460	1085	565

DX

A61AJ	35,088,914	8806	1162
DL8WPX	18,949,707	7195	1197
LZ9W	16,735,552	6861	1136
ZL6QH	16,143,840	4193	1010
LY7A	10,291,494	5115	978
JE1ZWT	8,343,780	3032	885
JA1ZLO	1,357,920	1069	492
OH2K	975,201	1129	519
HF65ØD	667,285	822	421
JA1YPA	632,052	603	388

CHECK LOGS

The following were used as check logs. Check logs are always appreciated:

4X4REM, 4X6HP, 9A6NKN, DEØWAF, DJ8EN, DK5DWW, DL7VRG, EW2EG, HAØLP, HA2ØØ4EU, HA5X, HSØXNO, HS5AYO, HS9EQY, JJ8FHY, KX7J, LY2BIG, LY6M, LY7Z, LZ1CW, LZ3AB, LZ3PZ, LZ7H, LZ9MAY, N1NN, N5IJE, OK1DMP, OK1DSU, OK2ZW, OK8DCE, PY5AKW, PY7GK, RA4YM, RA6AAW, RD3AD, RK9CWW, RN9CWB, RU3AX, RU9UC, RV1OO, RV3IC, RV3ML, RWØBB/9, RW6AF, RW9TA, SM6BSK, SM6CNN, SP1BLE, SP1EGN, SP5BYC, SP5GNW, SP5NZN, SP5ULV, SP6DMJ, SP6IHE, SP6YF, SP9BNM, SV5/SM8C, SV8CS, UA1AUW, UA1CBM, UA1NFA, UA3AVR, UA3DCW, UA3DEE, UA4NAL, UA6JD, UN6GN, UT3NF, UT3UA, UT7WZA, UUØJC, UX1IL, UX1UA, VE3NEA, WB4HUX, YL2GTD, YO2CMI, Z31GX, ZA/Z35M, ZX2B.

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Here's at look at some of the articles we're working on for upcoming issues of *CQ Amateur Radio*:

Mobile Special in May!
"Simple Mobile Antennas for 10 and 15 Meters," by WA2KBZ
"How to Finish Up USA-CA," by KØZT
"CQ Reviews: ICOM IC-2720 Dual- Band FM Mobile," by WB6NOA
Plus . . . Results: 2002 CQ/RJ WW RTTY DX Contest
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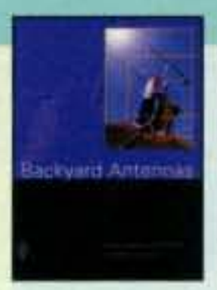

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IC-8 8-cell AA case (w/ Charge Jack !) $22.95
For KENWOOD TH-F6A / F7: (Lithium ION & Charger !)
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For KENWOOD TH-G71 / K, TH-D7A : (w/ Belt Clip. NEW)
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For KENWOOD TH-205 / 215 / 225 / 315 etc :
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For KENWOOD TR-2500 / 2600 : (Wall charger: $ 12.95 ea)
PB-25s (NI-Cd, w/ jack) 8.4v 800mAh $29.95
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No other Amateur transceiver offers you 400 Watts of transmitter power, for the biggest, cleanest voice on the bands. And switching to Class-A operation at 100 Watts of output, you enjoy the benefits of ultra-low distortion others can't match at 100 Watts!

400-Watt Future Production Model
Dual Metering + LCD Display
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Three "μ" RF Tuning Modules, covering 160 – 20 m Band
Internal Switching Power Supply

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For the Truly Serious Competitor

FT DX 9000 Contest

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* Specifications depend on country of sale.

To request a copy of the FT DX 9000 Technical Overview, please call (714) 827-7600, Ext. 2272

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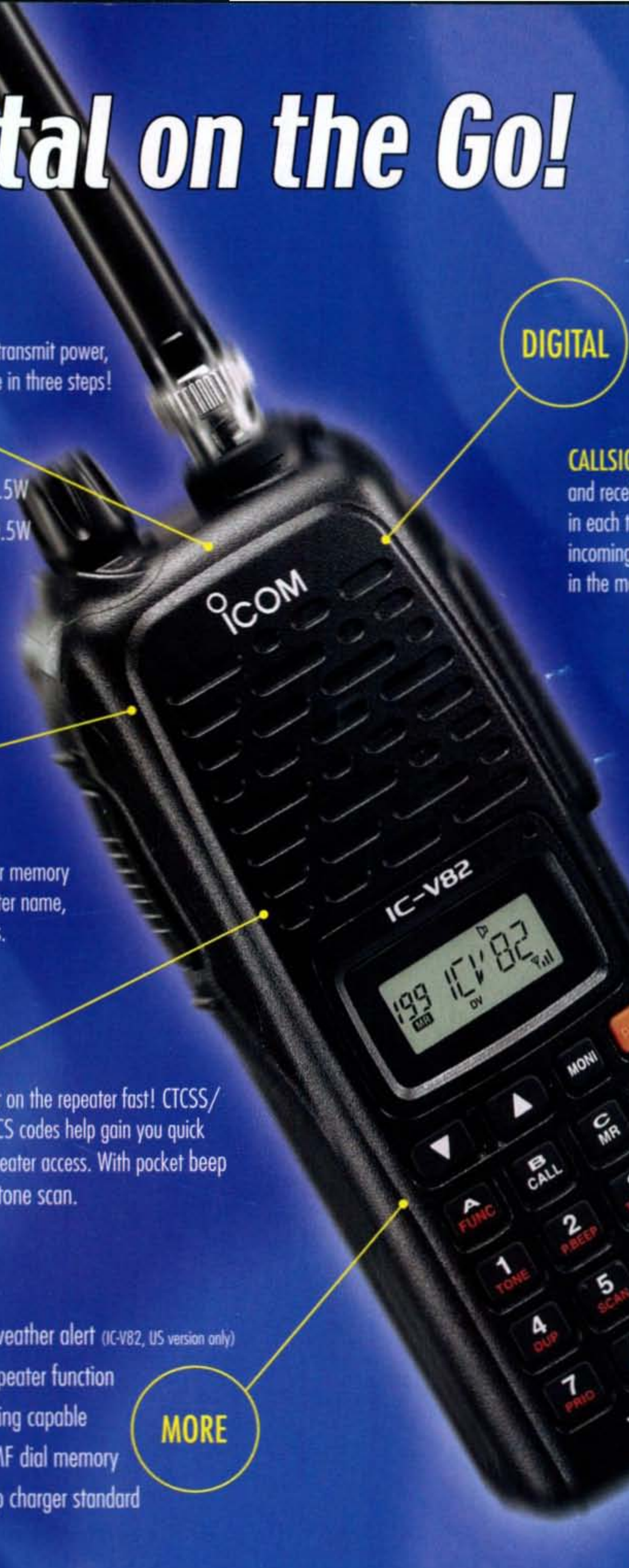

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